DRAFT

ENVIRONMENTAL ASSESSMENT

For

PHOTOVOLTAIC and BATTERY ENERGY STORAGE SYSTEMS

At

PACIFIC MISSILE RANGE FACILITY, KAUAI, HAWAII

January 2017

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Abstract

Designation:	Environmental Assessment
Title of Proposed Action:	Photovoltaic and Battery Energy Storage Systems
Project Location:	Pacific Missile Range Facility, Barking Sands, Kauai
Lead Agency for the EA:	Department of the Navy
Affected Region:	Kauai County, Hawaii
Action Proponent:	Pacific Missile Range Facility
Point of Contact:	PMRF Photovoltaic EA Project Manager Naval Facilities Engineering Command Pacific 258 Makalapa Drive, Suite 100 Pearl Harbor, Hawaii 96860-3134 NFPAC-Receive@navy.mil
Date:	January 2017

The Department of the Navy (Navy) has prepared this Environmental Assessment in accordance with the National Environmental Policy Act (NEPA), as implemented by the Council on Environmental Quality Regulations and Navy regulations for implementing NEPA. The Proposed Action includes the leasing of Navy land for the construction and operation of a utility scale photovoltaic system (PV) and battery energy storage system (BESS) at the Pacific Missile Range Facility (PMRF), Kauai. Project implementation would occur with lease execution. Construction is anticipated to start by no sooner than December 2017. This EA evaluates the potential environmental impacts associated with the Proposed Action and the No-Action Alternative to the following resource areas: air quality, water resources, geological resources, cultural resources, biological resources, land use, visual resources, airspace, noise, infrastructure, transportation, public health and safety, and hazardous materials and wastes.

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EXECUTIVE SUMMARY

Proposed Action

The Department of Navy (Navy) Renewable Energy Program Office (REPO) and Pacific Missile Range Facility (PMRF) are proposing a renewable energy project consisting of combined utility-scale photovoltaic (PV) array and battery energy storage system (BESS) that would improve power quality and energy resiliency in support of PMRF. Several technologies (panels, inverters, racking system, battery, controls, etc.) are combined for the project to function. The PV system would be combined with the BESS. Typically, the PV would charge the BESS during the day and then the BESS would discharge at night to provide power to the community. The Proposed Action is intended to provide electricity to PMRF in the event of a utility power outage; improve power quality to reduce the daily need to operate diesel generators in support of current and future mission operations and testing capabilities; and demonstrate leadership and successful partnerships by reaching the Navy's renewable energy goals. The proposed PV and BESS systems would provide PMRF with BESS-augmented proximally-generated power to supplement the more vulnerable and lower quality power from the distal Eleele Power Plant, and would provide an alternative source of energy to reduce dependence on fossil fuels. Operation of the PV system would result in an overall reduction of carbon dioxide emissions. With the completion of the project, PMRF could become a net zero energy installation.

The solar PV system could generate up to 44 megawatts (MW) of direct current (DC) electrical power and would feed this electricity into the Kauai Island Utility Cooperative (KIUC) electrical grid for all users, public and military. The land underlying the PV and BESS facilities would be leased for up to 40 years, including three years of construction, after which, the lease may be renewed or the facilities may be decommissioned. The Proposed Action could be constructed in phases, for example Phase I, Site A [87 acres] and Phase II, Site B [94 acres] or developed as one project. Phase 1 would produce up to 21 MW DC; Phase 2 would produce up to 23 MW DC. The actual generating capacity of the PV system would vary depending on environmental, technical and economic factors. New electrical transmission lines would be installed either overhead or underground (based on final engineering design) to connect the proposed projects to the existing KIUC transmission line along Kaumualii Highway. The proposed connection routes include Tartar Drive and Lighthouse Road. Both connection routes have existing 12.47 kilovolt (kV) overhead electrical distribution lines. However, new poles would be required for the proposed 57 kV overhead transmission lines. These new transmission line utility poles would replace the existing distribution line poles, and both the proposed transmission lines (57 kV) and the existing distribution lines (12.47 kV) would be placed upon the new poles.

The Navy is the lead agency for the Proposed Action; PMRF is the action proponent.

Purpose of and Need for the Proposed Action

The purpose of the Proposed Action is to provide PV and BESS facilities to improve Navy energy security and reduce the demand for energy produced by non-renewable resources by establishing renewable energy generating assets on PMRF. The need for the Proposed Action is to assist the Navy in meeting the Secretary of the Navy's renewable energy goals based on the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007, as well as the National Defense Authorization Act's renewable energy goals.

Alternatives Considered

Alternatives were developed for analysis based upon the following reasonable alternative screening factors: (1) mission compatibility (2) availability of contiguous land; (3) placement and topography; (4) proximity to transmission line; and (5) cultural resource constraints; and (6) biological resource constraints. The Navy is considering the Proposed Action and a No Action Alternative. The Proposed Action involves the leasing of up to 181 acres of Navy land at PMRF to a qualified developer for the construction, operation and decommissioning of PV and BESS facilities. Under the No Action Alternative, the PMRF site would not be leased for PV and BESS facilities. The No Action Alternative would prolong the existing energy security risk that results from PMRF's reliance on a single electrical transmission line over the long distance from Eleele Power Plant to deliver electricity, and back-up diesel generators to serve the entire installation's electrical requirement.

Summary of Environmental Resources Evaluated in the EA

Council on Environmental Quality (CEQ) regulations, National Environmental Policy Act (NEPA), and Navy instructions for implementing NEPA, specify that an Environmental Assessment (EA) should address those resource areas potentially subject to impacts. In addition, the level of analysis should be commensurate with the anticipated level of environmental impact.

The following resource areas have been addressed in this EA: air quality, water resources, geological resources, cultural resources, biological resources, land use, visual resources, airspace, noise, infrastructure, transportation, public health and safety, and hazardous materials and wastes. Because potential impacts were considered to be negligible or nonexistent, the following resources were not evaluated in this EA: marine resources, socioeconomics, and environmental justice.

Summary of Potential Environmental Consequences of the Action Alternatives and Major Mitigating Actions

Air Quality. The No Action Alternative would not reduce the supply of energy generated from fossil fuel sources and the associated negative air quality impacts would continue. Construction of the Proposed Action would have short-term, less than significant air quality impacts. Temporary air emissions would be generated during the construction period including emissions from construction equipment and dust, which would be minor and of short duration. Because the State of Hawaii is in attainment of the National Ambient Air Quality Standards, the Proposed Action is not subject to the Clean Air Act's General Conformity Rule. All construction activities would comply with the provisions of Hawaii Administrative Rules (HAR) 11-60.1-33 (Fugitive Dust). During the operational period, the Proposed Action would have beneficial impacts on air quality. None of the PV system components emit air pollutants. Some emissions would result from vehicles travelling to and from the PV sites for periodic maintenance but these effects would involve relatively short distances and brief periods of time. The Proposed Action would provide long-term beneficial effects on air quality and greenhouse gas (GHG) emission. The renewable energy generated by the proposed PV systems would reduce KIUC's dependence on energy generated from the burning of fossil fuels, and could reduce the daily need to operate diesel generators for mission operations at PMRF.

Water Resources. The No Action Alternative would not impact water resources. The Proposed Action would have less than significant impacts to water resources. It would not introduce new sources of pollutants or contaminants into groundwater pathways. During construction, water would be dispensed by water trucks or temporary irrigation systems to control fugitive dust and wet down exposed ground. Creation and use of construction staging and work areas would involve ground disturbance, which has

the potential to result in temporary impacts such as sediments or pollutants being transported to surface waters. However, construction period best management practices (BMPs) and compliance with required permits such as a National Pollutant Discharge Elimination System (NPDES) permit would avoid or minimize potential impacts to offsite stormwater receiving waters. The Proposed Action is not located in a floodplain, and would not result in the destruction or modification of or involve new construction in known wetlands. During the operational period, the Proposed Action would have no significant impact on water resources. Impervious surfaces on the project site would be increased, but the pre-development hydrology of the property with regard to temperature, rate, volume, and duration of flow, would be restored to the maximum extent practicable.

Geological Resources. The No Action Alternative would have no impacts on geological resources. During the construction period, the Proposed Action would have less than significant impacts on geological resources. It would not affect unique geological features or landmarks. Fill material with appropriate characteristics would be used to backfill areas excavated during construction. Ground-altering construction activities would comply with all applicable regulatory requirements including BMPs to control soil erosion and sedimentation during construction activities. During the operational period, the Proposed Action is expected to have no significant impact on geological resources.

Cultural Resources. The No Action Alternative would have no impacts on cultural resources. The Proposed Action would have no significant impact on cultural resources. The proposed PMRF project area is located within an area of low archaeological sensitivity. Previous archaeological studies indicate that the area has been extensively modified by construction and modern activities and has little to no potential to yield evidence of traditional Hawaiian archaeological sites. The proposed transmission line connection corridors extend beyond the PMRF installation boundary onto land owned by the State of Hawaii. Archaeological investigations of these areas documented significant 20th century land alterations with no evidence of cultural deposits (Masterson et al. 1994). Three historic landscape features (Nohili Road, Tartar Drive, and the House Area Gate on Tartar Drive) are located within or adjacent to the proposed project sites. However, the Proposed Action would not affect the character defining features of the roads or the gate. In consideration of the above information, the Navy has determined that the proposed project would have “no adverse effect” on historic properties under Section 106 of the National Historic Preservation Act (NHPA). The Navy has notified the SHPO and Native Hawaiian Organizations (NHOs) of their intent to develop the Proposed Action and has requested concurrence with their determination of effect by letters dated October 28, 2016 and November 10, 2016 respectively (see Section 106 consultation correspondence in Appendix C).

Biological Resources. The No Action Alternative would have no impacts on biological resources. The Proposed Action would have less than significant impacts on vegetation, wildlife, and threatened and endangered species. Temporary impacts on threatened, endangered or candidate terrestrial species could occur from noise associated with construction activities. However, these species at PMRF-Barking Sands are already habituated to high levels of noise associated with past construction and ongoing operational activities. The construction of the Proposed Action would include the clearing of vegetation, which would disturb wildlife residing on the project site. However, the project site does not include critical habitat, and wildlife that may be disturbed during construction could easily relocate to similar habitat in adjacent areas. If threatened, endangered, or candidate species are observed at the project site during construction, appropriate avoidance and mitigation measures, promulgated by the United States Fish and Wildlife Service (USFWS), would be taken to avoid or minimize potential impacts. During the operational period, skirting would be placed around the PV arrays as necessary to prevent the shaded area underneath the panels from becoming a habitat for feral animals. To minimize the potential of seabird fallout or disorientation and avoid potential impacts to nocturnal birds, permanent outdoor

lighting shall be on motion sensors, fully shielded, downward facing, utilizing light-emitting diodes, and in compliance with PMRF Dark Skies Program Requirements. The proposed transmission line connections could pose a threat to migratory birds which may strike the transmission lines. PMRF personnel will survey the area under the new utility lines to check if nocturnal seabirds collide with the transmission lines, and management strategies will be altered if birds are found to have collided with the new transmission lines. Pursuant to the Sikes Act Improvement Amendment (SAIA) and Section 7(a)(2) of the Endangered Species Act (ESA), the Navy has requested USFWS informal consultation and concurrence with its finding that the Proposed Action may affect, but is not likely to adversely affect (NLAA) the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*); nocturnal seabirds (*Puffinus auricularis* (Newell's Shearwater), *Pterodroma sandwichensis* (Hawaiian petrel), and *Oceanodroma castro* (Band-rumped Storm-petrel); and the *nēnē* (*Branta sandvicensis*) by letter dated December 19, 2016 (see ESA Section 7 consultation correspondence in Appendix B).

Land Use. The No Action Alternative would have no impacts on land use. The Proposed Action would have no significant impacts on existing adjacent PMRF or private land uses. The County of Kauai West Side Planning District Land Use Map does not cover PMRF, but it does identify the adjacent landfill, shrimp farm, and seed corn complex as agricultural land uses, and the Kauai Raceway Park as open space. The proposed PV and BESS systems would be compatible with these adjacent land uses. The Navy/Marine Corps and the State of Hawaii's Office of Planning have come to an agreement that certain activities listed on the "Navy/Marine Corps *De Minimis* Activities Under the Coastal Zone Management Act (CZMA)" (*De Minimis* Activity List) are not subject to further review by the Hawaii Coastal Zone Management Program when such activities are conducted in accordance with specified "Project Mitigation/General Conditions." The Proposed Action to lease land for the construction and operation of PV and BESS systems at PMRF is consistent with Items 1 and 2 on the *De Minimis* Activity List regarding New Construction and Utility Line Activities. Notification of the use of the list and the preparation of the EA to the State of Hawaii Coastal Zone Management (CZM) Program was prepared and submitted on October 4, 2016. The State CZM Program acknowledged receipt of the Navy's notification by email dated October 4, 2016 (see CZMA consultation correspondence in Appendix A).

Visual Resources. The No Action Alternative would have no impacts on visual resources. The Proposed Action would have less than significant impacts to visual resources in the project area. Due to the fairly level terrain of the Mana Plain, and because of its location, distance, and low-profile, the proposed PV array would be only minimally visible to the public from Kaumualii Highway. Potential effects from the Proposed Action on the scenic roadway corridor along Kaumualii Highway include the removal of vegetation from the proposed PV sites, and the construction of the proposed substation and BESS facilities at the Tartar Drive and Lighthouse Road locations indicated in Figure 2-3. The substation and BESS facilities could be visible from Kaumualii Highway, however, their industrial appearance would be consistent with the existing equipment and support facilities that define the visual characteristics of the Sunrise Shrimp Farm (that lies between the highway and the proposed PV sites). New transmission lines and poles would be extended along Tartar Drive and Lighthouse Road from the proposed PV substations to the existing KIUC 57kV transmission line along Kaumualii Highway. The new poles and lines are not expected to result in negative visual impacts since their appearance would be similar to the existing distribution lines and poles which currently exist in both corridors.

Airspace. The No Action Alternative would have no impacts on airspace. The Proposed Action would have less than significant impacts on airspace surrounding the PMRF runway used for military aircraft. The PMRF-Barking Sands airfield is not available for civilian, commercial, or recreational flights, and it is not a federally obligated airport. The Solar Glare Hazard Analysis Tool (SGHAT) analysis shows generally, there would be no effect on the air traffic control tower or aircraft except for aircraft on a curved

approach to Runway 34. The analysis identifies that glare with a potential for temporary after-image would be limited to a two hour period between 6:00 a.m. and 8:00 a.m. during the months March, April, May, August, September, and October if a fixed racking structure was chosen for the PV arrays, or a one hour period between 6:00 p.m. and 7:00 p.m. during the months of March and September if a tracking racking structure was chosen. The intensity and duration of the potential glare effects would vary based on the time of the year (i.e., the sun's location in the sky) and local weather, but the potential effects would not exceed the time ranges provided.

Noise. The No Action Alternative would have no impacts on baseline noise levels. Construction of the Proposed Action would result in less than significant impacts to noise resources. Construction noise may temporarily affect the occupants of noise-sensitive receptors in the vicinity of the PV sites. Noise from construction vehicles, machinery, equipment, and power tools would be the dominant source of construction noise, and the Navy Gateway Inn and Suites (NGIS) and the Terminal High Altitude Aerial Defense (THAAD) facilities bordering the PV sites and the adjacent Sunrise Shrimp Farm would be the most susceptible to construction noise impacts. However, measures would be implemented to minimize noise, and the contractor would be responsible for compliance with all applicable regulatory requirements for noise control, including Chapter 11-46, Hawaii Administrative Rules (HAR) regarding Community Noise Control. Once it is operational, the Proposed Action would have no significant noise impacts.

Infrastructure. The No Action Alternative would not increase the supply of energy generated from renewable sources for public and military use, and would prolong the existing energy security risk that results from PMRF's reliance on a single electrical transmission line and back up diesel generators to serve the entire installation's electrical requirement. The Proposed Action would have less than significant impacts on water service, drainage, and solid waste disposal. The Proposed Action would require the installation of two new transmission line corridors to connect the proposed PV sites to the existing 57 kV transmission line along Kaumualii Highway. The layout and installation of the new electrical lines and equipment required to service the proposed PV systems would be coordinated with KIUC to ensure that all applicable design and operational criteria are addressed. During the operational period, the Proposed Action would have the beneficial impact of generating renewable energy for public and military use, and enhancing energy security at PMRF.

Transportation. The No Action Alternative would have no impacts on transportation. The Proposed Action would have temporary, less than significant impacts on transportation resources during construction. The use of public roadways would be required to transport construction materials; provide construction and maintenance workers with access to and from the PV sites; and haul green waste and construction waste materials away for disposal. The Proposed Action would also require connection to the existing KIUC 57 kV transmission line within the Kaumualii Highway right of way (ROW). To minimize traffic-related impacts during construction, appropriate traffic management measures would be included in the construction documents to control material deliveries, use of privately owned vehicles on-base, and allowable interruptions in on base traffic. Installation of the proposed transmission line connections in the Kaumualii Highway ROW would be coordinated with the Hawaii DOT. During the operational period, maintenance of the PV systems would require periodic trips to each site to clean the PV panels, trim overgrown vegetation, and check the PV panels and equipment. Since the PV systems are unmanned facilities, they would generate very few additional vehicle trips, and would not involve activities that would significantly impact traffic.

Public Health and Safety. The No Action Alternative would have no impacts on public health and safety. The Proposed Action would have no significant impacts on public health and safety. It does not pose a risk to public health and safety as access to PMRF is restricted and entry to the PV sites would be controlled by the operator of the PV systems and limited to maintenance purposes. The Proposed Action would be an unmanned facility which would not extend the service area limits for police, fire and rescue, and emergency medical services nor would it create a need or demand for new or additional public services.

Hazardous Materials and Waste. The No Action Alternative would have no impacts on hazardous materials and waste. The Proposed Action would have no significant impacts on hazardous materials and waste. The batteries used in the BESS may contain hazardous substances, however, batteries are typically housed entirely within a battery container system (BCS). The BCS could include the container, battery enclosures, control system, internal wiring, cooling system, fire suppression system, battery rack system, and interfaces for battery management system.

Table ES-1 provides a tabular summary of the potential impacts to the resources associated with each of the alternative actions analyzed.

Public Involvement

The Navy published the Draft EA for public review from February 3, 2017 to March 5, 2017.

Table 3-6 Summary of Potential Impacts to Resource Areas

Resource Area	*No Action Alternative*	*Proposed PV Photovoltaic and Battery Energy Storage Systems*
Air Quality	Continued reliance on fossil fuel power sources and the associated GHG emissions and effects.	Construction: Less than significant impacts. Temporary, less than significant impacts from construction vehicle and equipment emissions and fugitive dust. Best management practices (BMPs) including dust fences, water wagons and/or sprinklers would be used to control fugitive dust emissions during construction. Operations: Beneficial impacts. Vehicular emissions from occasional trips to the PV sites for system maintenance would have a minimal impact on air quality. Decrease in GHG emissions due to the reduction of fossil fuel used to produce electricity would have a long-term beneficial impact.
Water Resources	No impact	Construction: Less than significant impacts. Hazardous materials (coolants, fluids, oils) from equipment, machinery, and vehicles could contaminate groundwater. BMPs such as proper storage of hazardous materials and immediate cleanup of leaks or spills would be implemented to prevent contamination of groundwater resources. Operations: No significant impacts. The unmanned PV systems would only require water for fire protection and periodic cleaning of PV panels.
Geological Resources	No impact	Construction: Less than significant impacts. The fairly flat, previously developed site would require minimal site preparation/grading. Temporary impacts from fugitive dust and soil erosion and sedimentation would be avoided or minimized through BMPs to control dust emissions (see air quality discussion above) and compliance with NPDES permit conditions regarding construction period erosion and sedimentation control. Operations: No significant impacts.

Table 3-6 Summary of Potential Impacts to Resource Areas

Resource Area	*No Action Alternative*	*Proposed PV Photovoltaic and Battery Energy Storage Systems*
Cultural Resources	No impact	Construction and Operations: No significant impacts. Three historic landscape features (Nohili Road, Tartar Drive, and the House Area Gate on Tartar Drive) are located within or adjacent to the proposed project sites. However, the Proposed Action would not affect the character defining features of the roads or the gate. The project sites are located in an area that was previously disturbed and no archaeological sites are anticipated. No archaeological sites or historic structures have been identified in the project area or surrounding area. The Proposed Action would have "no adverse effect" on historic properties under Section 106 of the NHPA.
Biological Resources	No impact	Construction: Less than significant impacts. The Navy has determined that the Proposed Action may affect, but is not likely to adversely affect (NLAA) threatened, or endangered species. Site clearing would remove vegetation, the project site does not include critical habitat for threatened, or endangered vegetation or wildlife. The endangered *nēnē* have been observed on the PV sites. The PV sites could support roosting and/or pupping for the endangered Hawaiian hoary bat. Migratory seabirds, including the threatened Newell's shearwater, endangered Band-rumped Storm-petrel, and endangered Hawaiian petrel could traverse the project area. Appropriate mitigation measures, promulgated by USFWS, would minimize impacts to these endangered species. Operations: Less than significant impacts. Skirting would be placed around the PV arrays as necessary to prevent the shaded area underneath the panels from becoming a habitat for feral animals. To minimize the potential of seabird fallout or disorientation and avoid potential impacts to nocturnal birds, permanent outdoor lighting shall be on motion sensors, fully shielded, downward facing, utilizing light-emitting diodes, and in compliance with PMRF Dark Skies Program Requirements. The proposed transmission line connections could pose a threat to migratory birds which may strike the transmission lines. PMRF personnel will survey the area under the new utility lines to check if nocturnal seabirds collide with the transmission lines, and management strategies will be altered if birds are found to have collided with the new transmission lines.

Table 3-6 Summary of Potential Impacts to Resource Areas

Resource Area	*No Action Alternative*	*Proposed PV Photovoltaic and Battery Energy Storage Systems*
Land use	No impact	Construction and Operations: No significant impacts. The proposed PV systems would be compatible with adjacent land uses, and the State of Hawaii Coastal Zone Management Program has acknowledged receipt of the Navy's notification of the use of the *de minimis* activity list under the Coastal Zone Management Act.
Visual Resources	No impact	Construction and Operations: Less than significant impacts. The proposed PV sites would be minimally visible from public views along Kaumualii Highway. Existing development (landfill, shrimp farm) obstruct views of the PV sites from the public highway. PV sites do not contain scenic features or lie within a public view corridor.
Airspace	No impact	Construction and Operations: Less than significant impacts. The PV sites do not lie within aircraft flight tracks or military runway approach paths. The analysis indicates that no glare impacts would be expected for the air traffic control tower or aircraft on straight approaches to Runways 16 and 34. The glint and glare analysis predicts glare with potential for temporary after-image for the curved approach to Runway 34.
Noise	No impact	Construction: Less than significant impacts. Temporary increase in ambient noise from activities, equipment, machinery and vehicles would be minimized by complying with local noise community control regulations. Operations: No significant impacts. Minimal and very localized noise from cooling fans and transformers.
Infrastructure	No impacts to water, drainage and solid waste disposal, but it does not increase renewable energy generation and it would prolong the existing energy security risks at that results from PMRF's reliance on a single electrical transmission line.	Construction: Less than significant impacts. Temporary impacts to electrical power, water, drainage, and solid waste disposal systems during construction period. Operations: No significant impacts. Minimal impacts to water, drainage, and solid waste disposal systems, and the beneficial impact of increased energy security and stability to the electrical power system.

Table 3-6 Summary of Potential Impacts to Resource Areas

Resource Area	*No Action Alternative*	*Proposed PV Photovoltaic and Battery Energy Storage Systems*
Transportation	No impact	Construction: Less than significant impacts. Vehicle trips by construction workers; deliveries of PV system components; and disposal of construction waste materials would require the use of public roadways. However, appropriate traffic management measures would be implemented to minimize potential impacts to local roadways and traffic. Operations: No significant impacts. The PV systems are unmanned facilities and would not generate consistent vehicle trips. Occasional vehicle trips to the PV sites for system maintenance would have little effect on traffic.
Public Health and Safety	No impact	Construction and Operations: No significant impacts. The PV sites are not affected by ESQD arcs, the Navy would coordinate the ground hazard area from seldom used South Launch Site, and site access controls would ensure safety and health requirements for children.
Hazardous Materials and Wastes	No impact	Construction: No significant impacts. Temporary, secondary containment measures would be employed, to ensure that potential accidental releases of hazardous substances (e.g., anti-freeze, petroleum, oils, and lubricants) are prevented or limited in scope. Operations: No significant impacts. Potential exposure to hazardous materials could occur if inverters or transformers are broken and BESS components could pose a fire hazard. The project would utilize BMPs to minimize the exposure risk in accordance with all applicable regulations.

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Environmental Assessment for Photovoltaic and Battery Energy Storage Systems At Pacific Missile Range Facility, Kauai

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Abbreviations and Acronyms

Acronym	Definition
AC	alternating current
ACHP	Advisory Council on Historic Preservation
AICUZ	Air Installation Compatible Use Zone
AMSL	above mean sea level
APE	Area of Potential Effect
APZ	Accident Potential Zone
BCS	Battery container system
BESS	Battery energy storage system
BMP	best management practice
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CNRH	Commander Navy Region Hawaii
CO	carbon monoxide
CO_2	carbon dioxide
CWA	Clean Water Act
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
dB	decibel
dBA	A-weighted sound level
DC	direct current
DoD	United States Department of Defense
DOT	Hawaii Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EO	Executive Order
ESA	Endangered Species Act
ESQD	explosive safety quantity distance
FAA	Federal Aviation Administration
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
GHG	greenhouse gas
HAR	Hawaii Administrative Rules
Hz	hertz
IDP	Installation Development Plan
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
KDOW	Kauai Department of Water
KFD	Kauai Fire Department
KPD	Kauai Police Department
kV	kilovolt
kVa	kilovolt amperes
kW	kilowatt
KIUC	Kauai Island Utility Cooperative
MILCON	Military construction
MMPA	Marine Mammal Protection Act
MSL	mean sea level

Acronym	Definition
MSWLF	Municipal Solid Waste Landfill
MW	megawatts
MW DC	megawatts of direct current
NAAQS	National Ambient Air Quality Standards
Navy	Department of the Navy
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NGIS	Navy Gateway Inn and Suites
NHO	Native Hawaiian organizations
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NZEI	Net zero energy installation
OPNAV	Office of the Chief of Naval Operations
OPNAVINST	Office of the Chief of Naval Operations Instruction
PA	Programmatic agreement
PM_{10}	particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
PMRF	Pacific Missile Range Facility
PV	photovoltaic
ROI	Region of influence
SECNAV	Secretary of the Navy
SGHAT	Solar Glare Hazard Analysis Tool
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	sulfur dioxide
SOP	Standard operating procedure
TCP	Traditional Cultural Property
THAAD	Terminal High Altitude Aerial Defense
TMDL	Total maximum daily load
UFC	Unified Facilities Criteria
U.S.	United States
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1 Purpose of and Need for the Proposed Action

1.1 Introduction

The Navy proposes to lease up to 181 acres of U.S. Department of Defense (DoD) land to a qualified developer for the construction, operation and decommissioning of a combined utility-scale photovoltaic (PV) array and battery energy storage system (BESS) (hereinafter referred to as the "System") on the Pacific Missile Range Facility (PMRF), Barking Sands. The action would take place following a lease agreement. Construction is anticipated to start no sooner than December 2017. The solar PV system would generate up to 44 megawatts (MW) of direct current (DC) electrical power and would feed into the island-wide Kauai Island Utility Cooperative (KIUC) electrical grid for public and military use. The BESS would primarily be used to store solar energy produced by the solar PV system during the day and then discharge the energy to the grid at night. The intent is that the BESS will be designed to provide power to the installation during contingency situations when the KIUC grid supply is not reliable. The land underlying the PV and BESS facilities would be leased for up to 40 years after which time the lease may be renewed or the facilities decommissioned.

The United States (U.S.) Department of the Navy (Navy) has prepared this Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA), as implemented by the Council on Environmental Quality Regulations and Navy regulations for implementing NEPA.

The Navy is the lead agency for the Proposed Action; PMRF is the action proponent.

1.2 Location

PMRF-Barking Sands is located in Hawaii on the western shore of the Island of Kauai. It encompasses 2,134 acres of the coastal fringe of the Mana Plain along Kauai's western shore. PMRF Open Ocean Areas to the north, south, and west of Kauai include over 1,100 square miles of instrumented underwater ranges, over 42,000 square miles of controlled airspace, and a Temporary Operating Area covering 2.1 million square nautical miles of ocean area designated as W-188. This unique ocean range, combined with the highly technical instrumentation at the various base facilities can simulate a realistic environment for testing and training in the use of air, submarine, and surface weapon systems, as well as land-based weapon systems. Navy, Air Force, Army, Marine Corps, and allied research, development, test, and evaluation programs, and other non-DoD agencies and commercial industry, all utilize PMRF.

PMRF is both a Navy fleet training range and a DoD military test range. PMRF's mission is to provide integrated range services in a modern, multi-threat, multi-dimensional environment that ensures the safe conduct and evaluation of both training and test and evaluation missions.

The PV and BESS facilities are proposed to be located within the boundaries of the PMRF installation on two separate sites along an existing installation roadway (Nohili Road). The proposed sites are bordered by private aquaculture shrimp farms to the east on State land (Sunrise Shrimp Farm), Tartar Drive to the north, Nohili Road to the west, and Lighthouse Road / Kokole Point Road to the south. An existing Navy facility separates the two proposed sites with Site A to the north of the facility, and Site B to the south of the facility. The Proposed Action could be constructed in phases such as Phase I, Site A [approximately 87 acres] and Phase II Site B [approximately 94 acres] or developed at one time. The Proposed Action could include the installation of up to two upgraded transmission lines, along Tartar Drive and/or Lighthouse Road, to connect the proposed PV substations to KIUC's 57 kV transmission line along Kaumualii Highway.

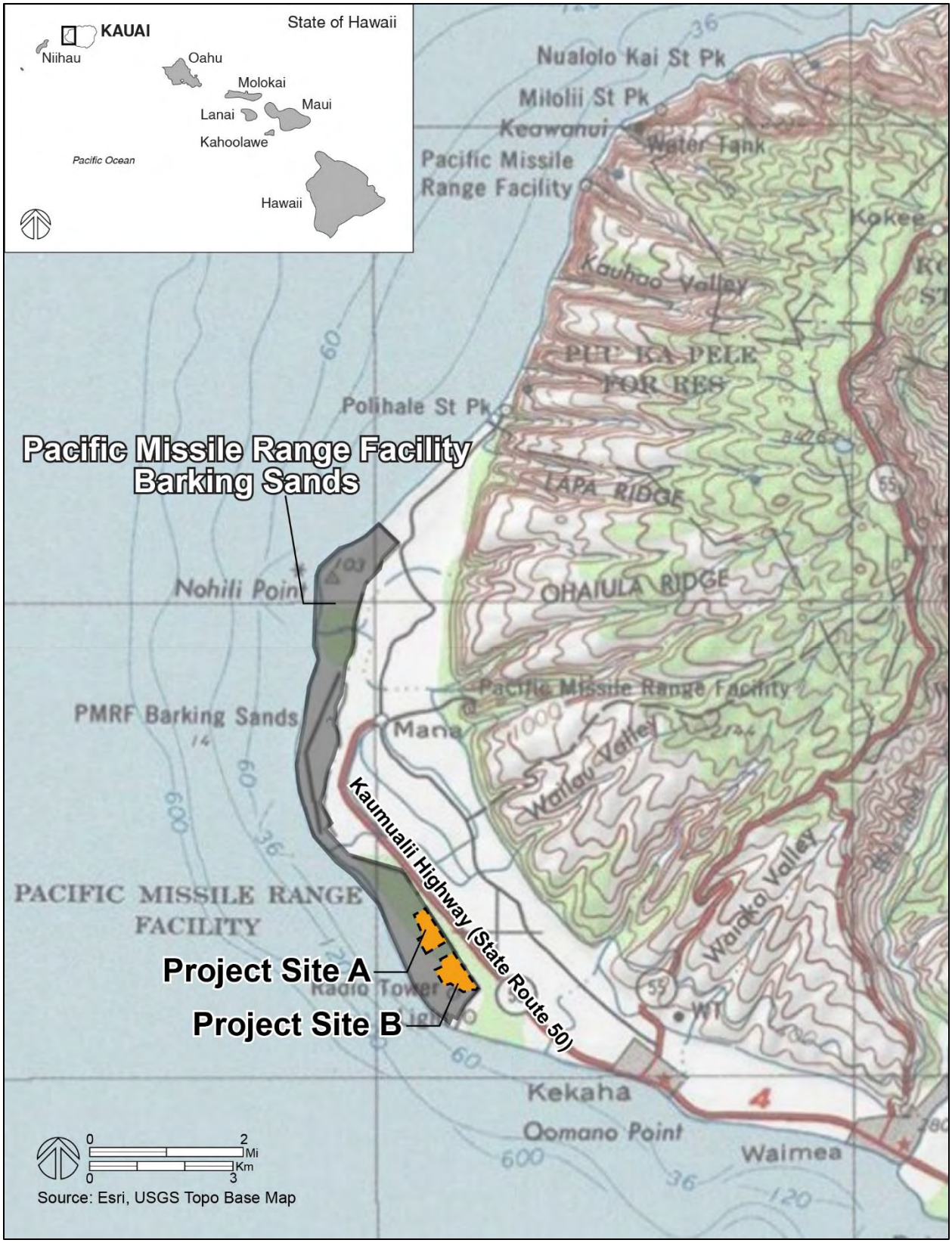


Figure 1-1 Project Location Map

1.3 Purpose of and Need for the Proposed Action

The purpose of the Proposed Action is to improve Navy energy security and increase the supply of energy produced from renewable resources by enabling the development of renewable energy generating assets on PMRF. The Proposed Action is intended to provide electricity to PMRF in the event of a utility power outage; improve power quality to reduce the daily need to operate diesel generators in support of current and future mission operations and testing capabilities; and demonstrate leadership and successful partnerships by reaching the Navy's renewable energy goals. The proposed PV and BESS systems would provide PMRF with BESS-augmented proximally-generated power to supplement the more vulnerable and lower quality power from the distal Eleele Power Plant, and would provide an alternative source of energy to reduce dependence on fossil fuels.

The need for the Proposed Action is to provide a reliable, renewable energy resource and to assist the Navy in meeting the Secretary of the Navy's renewable energy goals, specifically:

- The Secretary of the Navy's (SECNAV) renewable energy goal for 50 percent of the Navy's shore-based energy requirements to be produced or procured from alternative energy sources by the year 2020
- The SECNAV renewable energy goal for 50% of Navy and Marine Installations to be net-zero by the year 2020
- The Memorandum of Understanding, signed 21 June 2016, between the State of Hawaii and the Assistant Secretary of the Navy to cooperate in meeting their mutual renewable energy goals, including the State of Hawaii commitment to reach a 100% renewable portfolio standard for electricity sales by 2045

1.4 Scope of Environmental Analysis

This EA includes an analysis of potential environmental impacts associated with the Proposed Action and the No Action Alternative. The environmental resource areas analyzed in this EA include: air quality, water resources, geological resources, cultural resources, biological resources, land use, visual resources, airspace, noise, infrastructure, transportation, public health and safety, and hazardous materials and wastes. The study area for each resource analyzed may differ due to how the Proposed Action interacts with or impacts the resource. For instance the study area for geological resources may only include the construction footprint whereas the noise study area would expand out to include areas that may be impacted by airborne noise.

1.5 Key Documents

Key documents are sources of information incorporated into this EA. Documents are considered to be key because of similar actions, analyses, or impacts that may apply to this Proposed Action. Council on Environmental Quality (CEQ) guidance encourages incorporating documents by reference. Documents incorporated by reference in part or in whole include:

- Memorandum for Director, Material, Readiness and Logistics Deputy Commandant for installations and logistics SECNAV Shore Energy Policy December 1st, 2011: This Memo outlines the SECNAV energy goals for the Navy. Some of the goals outlined in this memo and correlated to the Proposed Action are to "Increase Alternative Energy Ashore, by 2020, DON [Navy] would produce or procure at least 50% of the total quantity of electric energy consumed by shore-

based facilities and activities each fiscal year from alternative energy sources; 50% of DON [Navy] installations would be net-zero".

- Memorandum for Commander Navy Installations Command Marine Corps Installations Command Deputy Chief of Naval Operations for Fleet Readiness and Logistics Shore Energy Policy Requirement Guidance for Renewable Energy Program Office Model 2 projects, March 31, 2015: This Memo describes the REPO model 2 out-grant to provide on-base generation of renewable energy for on and off base consumption using the utility grid while enabling the Navy to receive direct energy benefits via the terms of the out-grant. The memo strongly encourages REPO to effectively prioritize and use this out-grant, when available to meet the standing Navy requirement of safe, reliable and affordable base-load power on Navy installations.
- **Installation Development Plan, September 2016**: Pacific Missile Range Facility Barking Sands, Installation Development Plan (IDP), September 2016, is a 20-year comprehensive master plan for the Navy installation. The IDP evaluates existing conditions—including but not limited to airfield and range operations, personnel support facilities, utilities and circulation—and recommends future development projects.

1.6 Relevant Laws and Regulations

The Navy has prepared this EA based upon federal and state laws, statutes, regulations, and policies that are pertinent to the implementation of the Proposed Action, including the following:

- NEPA (42 U.S.C. sections 4321-4370h), which requires an environmental analysis for major federal actions that have the potential to significantly impact the quality of the human environment
- CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 CFR parts 1500-1508)
- Navy regulations for implementing NEPA (32 CFR part 775), which provides Navy policy for implementing CEQ regulations and NEPA
- Clean Air Act (CAA) (42 U.S.C. section 7401 et seq.)
- Clean Water Act (CWA) (33 U.S.C. section 1251 et seq.)
- Coastal Zone Management Act (CZMA) (16 U.S.C. section 1451 et seq.)
- National Historic Preservation Act (NHPA) (54 U.S.C. section 306108 et seq.)
- Endangered Species Act (ESA) (16 U.S.C. section 1531 et seq.)
- Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (16 U.S.C. section 1801 et seq.)
- Marine Mammal Protection Act (MMPA) (16 U.S.C. section 1361 et seq.)
- Migratory Bird Treaty Act (MBTA) (16 U.S.C. section 703-712)
- EO 11988, Floodplain Management
- EO 12088, Federal Compliance with Pollution Control Standards
- EO 12114, Environmental Effects Abroad of Major Federal Actions
- EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations
- EO 13045, Protection of Children from Environmental Health Risks and Safety Risks
- EO 13089, Coral Reef Protection

- EO 13423, Strengthening Federal Environmental, Energy, and Transportation Management
- EO 13693, Planning for Federal Sustainability in the Next Decade

A description of the Proposed Action's consistency with these laws, policies and regulations, as well as the names of regulatory agencies responsible for their implementation, is presented in Chapter 5 (Table 5-1).

1.7 Public and Agency Participation and Intergovernmental Coordination

Regulations from the Council on Environmental Quality (40 CFR part 1506.6) direct agencies to involve the public in preparing and implementing their NEPA procedures. In accordance with DoD and Navy policies and instructions for implementing NEPA, comments from the public would be solicited for the Draft EA. Copies of the Draft EA would be provided to public libraries on Kauai and would be available over the Internet. A Notice of Availability of the Draft EA would be published in The Garden Island, the local Kauai newspaper, and in the Environmental Notice, the bi-monthly publication of the State of Hawaii, Office of Environmental Quality Control. All comments received during the Draft EA comment period would be fully considered by the Navy prior to rendering a decision on the Proposed Action.

As part of the NEPA compliance process, the Navy would engage in coordination, consultation, and permitting with regulatory agencies to ensure that all applicable laws, rules, regulations, and policies have been satisfied with respect to the Proposed Action. Table 1-1 summarizes the permits and consultation processes required for the Proposed Action.

Table 1-1 Agency Coordination and Permitting Requirements

Permit or Consultation	*Agency/Stakeholders*	*Status*
Coastal Zone Management Act (CZMA) *De minimis* acknowledgment	Coastal Zone Management Program, State of Hawaii Office of Planning	Completed
Endangered Species Act (ESA) Section 7, Informal Consultation	U.S. Fish and Wildlife Service	Initiated
National Historic Preservation Act (NHPA) Section 106	State of Hawaii Historic Preservation Officer, Native Hawaiian organizations, interested parties	Initiated
National Pollutant Discharge Elimination System (NPDES) Permit	State of Hawaii Department of Health	Forthcoming

The Proposed Action falls under the Navy's De Minimis Activities List (State of Hawaii CZM letter, dated July 9, 2009); notification of the use of the list and the preparation of the EA to the State of Hawaii Coastal Zone Management (CZM) Program was submitted on October 4, 2016. The State CZM Program acknowledged receipt of the Navy's notification by email dated October 4, 2016 (see CZMA consultation correspondence in Appendix A).

Pursuant to the Sikes Act Improvement Amendment (SAIA) and Section 7(a) (2) of the Endangered Species Act (ESA), the Navy has requested (USFWS) informal consultation and concurrence with its finding that the Proposed Action may affect, but is not likely to adversely affect (NLAA) the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*); nocturnal seabirds (*Puffinus auricularis* (Newell's

Shearwater), *Pterodroma* sandwichensis (Hawaiian petrel), and *Oceanodroma castro* (Band-rumped Storm-petrel)); and the *nēnē* (*Branta sandvicensis*) by letter dated December 19, 2016 (see ESA Section 7 consultation correspondence in Appendix B).

The Navy has notified the SHPO and Native Hawaiian Organizations (NHOs) of their intent to develop the Proposed Action and has requested concurrence with their determination of "no adverse effect" to historic properties by letters dated October 28, 2016 and November 10, 2016 respectively (see Section 106 consultation correspondence in Appendix C).

2 Proposed Action and Alternatives

2.1 Proposed Action

The Navy proposes to lease up to 181 acres of DoD land to a qualified developer for the construction, operation and decommissioning of a combined utility-scale PV array and BESS on PMRF, Barking Sands near Nohili Road. Solar panels utilize a packaged assembly of solar cells to harness solar energy (photons) from the sun and generate electricity. The panels generate direct current (DC) electricity, which is converted to alternating current (AC) electricity for transmission on the electrical grid and ultimate end-use in AC form.

The solar PV system could generate up to 44 MW DC electrical power and would feed into the KIUC electrical grid for public and military use. The land underlying the PV and BESS facilities would be leased for up to 40 years after which time the lease may be renewed or the facilities may be decommissioned.

The Proposed Action could be constructed in phases, for example Phase I, Site A [approximately 87 acres] and Phase II, Site B [approximately 94 acres] or developed as one project. Phase 1 would produce up to 21 MW DC; Phase 2 would produce up to 23 MW DC. The actual generating capacity of the PV system would vary depending on environmental, technical and economic factors.

The Proposed Action could include the installation of up to two short transmission lines to connect the proposed PV substations to KIUC's existing 57 kV transmission line along Kaumualii Highway. One proposed transmission line connection could be located within KIUC's perpetual non-exclusive transmission line easement along Tartar Drive, and would run from approximately 700 feet from PV Site A to KIUC's existing 57 kV transmission line along Kaumualii Highway. The other could be located within a U.S. Coast Guard-owned access Road (Lighthouse Road), and would run approximately 1,600 feet from PV Site B to KIUC's existing 57 kV transmission line along Kaumualii Highway (Figure 2-3).

2.2 Screening Factors

NEPA's implementing regulations provide guidance on the consideration of alternatives to a federally Proposed Action and require rigorous exploration and objective evaluation of reasonable alternatives. Only those alternatives determined to be reasonable and meet the purpose and need require detailed analysis.

Potential alternatives that meet the purpose and need were evaluated against the following screening factors:

- Mission compatibility: proposed development is compatible with PMRF existing/planned operational requirements; site development would not impact military training; to ensure economic feasibility, the site would be available for up to 40 years (not planned for other development in PMRF's Installation Development Plan)
- Availability of contiguous land: the site provides at least 65 contiguous acres of available land for the construction of the PV system and BESS facilities; the site can provide sufficient land to produce at least 15 MW DC electrical power
- Placement/topography: PV panels can be located to receive the maximum available unobstructed sunlight per day; land area(s) for ground-mounted PV panels is relatively flat; proposed development would not obstruct or interfere with the adjacent property

- Proximity to transmission line: the site is within close proximity to the existing transmission line; a new transmission line can be installed along existing roadways (disturbed area) to connect the substation to the electrical grid
- Cultural resource constraints: the Area of Potential Effect (APE) has been previously surveyed and determined to have little to no potential for affecting cultural/archaeological sites, traditional cultural properties, historic properties, or cultural landscape features.
- Biological Resource constraints: the PMRF Installation Natural Resources Management Plan (INRMP) indicates the project site is not located within the identified protected animal species habitat or the USFWS designated critical habitat for *lau'ehu* (*Panicum niihauense*) (CNRH, 2010).

2.3 Alternatives Carried Forward for Analysis

Based on the reasonable alternative screening factors and meeting the purpose and need for the Proposed Action, the Proposed Action and the No Action Alternative would be analyzed within this EA.

2.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. The No Action Alternative would prolong the existing energy security risk that results from PMRF's reliance on a single electrical transmission line to serve the entire installation's electrical requirement. The No Action Alternative would result in the continued daily need to operate diesel generators for mission operations. The No Action Alternative would not meet the purpose and need for the Proposed Action; however, as required by NEPA, the No Action Alternative is carried forward for analysis in this EA and provides a baseline for measuring the environmental consequences of the Proposed Action.

2.3.2 PV and BESS Systems (Proposed Action)

Glass-cased PV panels would be used for the PV array. The PV panels would be attached to a racking system and secured to the ground in groups to best utilize the dimensions of the available space. The panels would be darkly colored to minimize light reflection and would be approximately 3.5 feet long and 5 feet wide. Once installed, the PV array would be approximately 8 feet tall or less. The panels would be aligned and positioned to maximize sun exposure. Ballasts or piles would anchor the ground-mounted PV panel racking system. The type of racking structure (fixed versus tracking) would be determined by the developer during the proposed project's final engineering design. A fixed racking structure is one in which the PV panels are attached to a fixed assembly which locks the tilt and orientation of the panels. A typical tilt for sun exposure on a stationary racking structure at the proposed project location is equal to the latitude of 22 degrees and pointing to the south. A tracking racking structure is one in which the panels are attached to solar tracking assembly that allows the panels to follow the path of the sun throughout the day in a vertical and/or horizontal direction; tracking racking systems increase the efficiency of the system but also increase the cost for equipment and maintenance.

Mounting systems constructed of steel or concrete pilings, pile driven posts, poured reinforced concrete, or concrete ballasted systems would be used to support the racking structures (Figure 2-1). The racking structures would be designed to comply with all applicable wind load criteria. The racking structures can be designed to adapt to ground contours to minimize site work and ground disturbance. The racking systems could also be designed to facilitate the efficient placement, replacement, maintenance and cleaning of the PV panels.

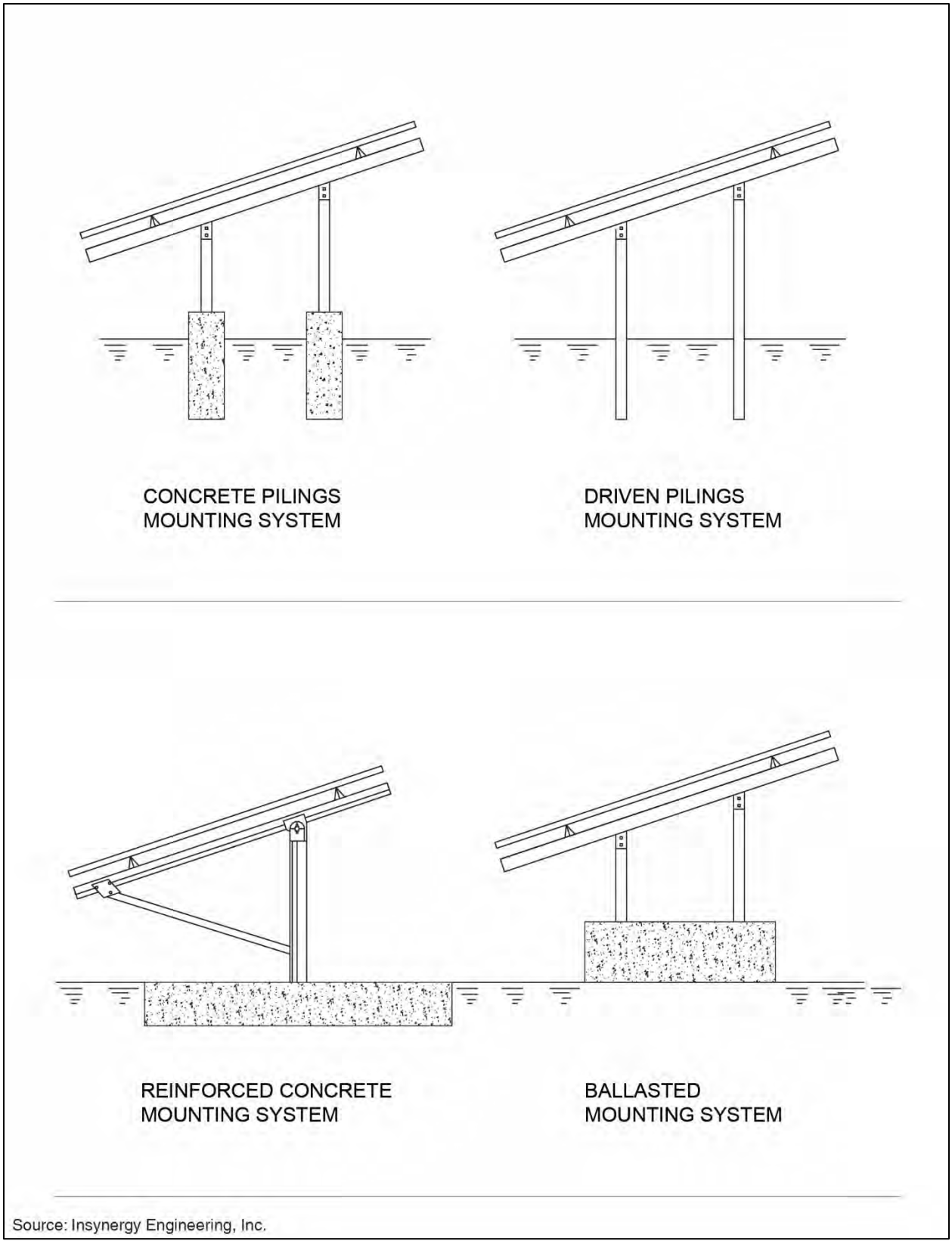


Figure 2-1 Ground Mount PV Foundation Types

Electrical cabling would be used to connect the individual PV modules and the larger electrical system. Where practical, cabling could be placed in trays above ground. In the event cable routing requires underground installation, such as the electrical connections between Site A and Site B, cables (in conduits) would be buried directly in excavations of minimal cross section with a required depth per the DoD Unified Facilities Criteria (UFC) and the National Fire Protection Association/National Electrical Code (NFPA 70) (typically 36 inches below grade). The conduit would then be covered with backfill and tamped to the appropriate level of compaction. Where conduit would cross under on-site service roads, concrete encasement could be used around conduits for mechanical protection against vehicular traffic.

The construction of several electrical system components including the inverter/transformer stations, substation, and BESS would require concrete slab foundations. The inverter/transformer stations are approximately ten feet square by ten feet tall, and would be distributed throughout the site with approximately one station per eight acres of PV array. The substation would include its own transformer, switchgear and a maintenance building (prefabricated). The substation and a transmission line extending to the nearest point of connection along KIUC's existing 57 kV overhead transmission line would transfer the power generated by the PV system to KIUC's electrical grid. The proposed project would include a BESS to provide dispatchable energy to balance fluctuations in energy generation caused by weather, seasons and nighttime darkness and to provide a temporary backup source of power during contingency conditions. The BESS is typically located near the PV system's substation. A maintenance building could be designed and sized based on what is appropriate for the project. The substation complexes would serve as the operations and maintenance hubs for the PV system, but they would cover only a small percentage of the project site's land area.

Depending on Navy and developer requirements, the PV site could be contained within an eight-foot-high perimeter fence (no barbed wire). Outdoor lighting could also be provided for security purposes; if required, such lighting would be on motion sensors, fully shielded and downward facing, utilize light-emitting diodes and comply with PMRF Dark Skies Program Requirements. The PV arrays would occupy most of the space within the fenced enclosure. A perimeter maintenance road could be located directly inside of the security fence, and would generally be 20 feet wide (Figure 2-2). Access roads within the array would typically be 10 feet wide. All roads would be constructed per final design but likely would consist of a gravel or similar base that would be trucked on site.

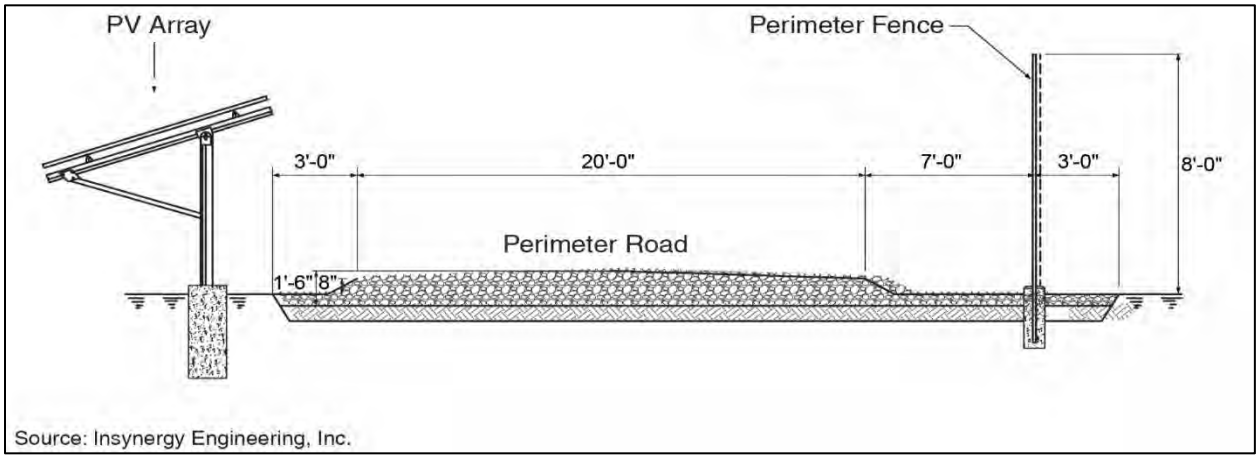


Figure 2-2 PV Site Typical Perimeter Road Detail

2.3.2.1 Site Preparation and Construction

During site preparation, surface vegetation in the areas to be developed would be cleared and grubbed (i.e., roots and stumps extracted), and the ground would be excavated and compacted where loadbearing foundations are proposed. Ground disturbance during construction would include site grading to establish positive drainage control, installation of the PV racking system and mounting systems, trenching for underground electrical cables, installation of overhead transmission line poles, foundation work for electrical equipment and site buildings, and miscellaneous civil works (i.e., perimeter fencing post holes and access roads). BMPs for soil erosion and sedimentation control would be implemented in accordance with project-specific drainage and erosion control plans which would comply with applicable NPDES requirements for construction-related activities. In addition, BMPs would be implemented, and retention basins or dry wells would be utilized as necessary, to ensure that stormwater runoff is retained on site and allowed to percolate into the ground or be discharged at a rate that would not exceed predevelopment runoff or significantly impact adjacent and downstream properties.

During construction, materials would be transported to the project sites by truck, where they would be stored, assembled (as necessary), and moved into place. Temporary construction laydown areas for materials, equipment, and parking would be provided on each site or on adjacent Navy property. Prior to construction, site boundaries or limits of disturbance would be surveyed and staked to identify areas where construction activities would occur. Dust barriers would be erected around active construction areas to minimize the effects of fugitive dust on adjacent land uses in the area.

2.3.2.2 PV Substation Utility Connection

The proposed PV substation (Figure 2-3) allows power generated and stored at the project site to be transformed to match the specification for interconnection with KIUC's electrical grid. The PV substation for Site A could be connected to a new proposed switching station which would be constructed as part of a separate military construction (MILCON) project (P-416) to consolidate the electrical grids at PMRF. The new proposed switching station could be collocated with the proposed PV substation, or could be constructed adjacent to the PV Site A along Tartar Drive. New electrical transmission lines would be installed either overhead or underground (based on final engineering design) to connect the proposed project's substations and/or the P-416 switching station to the existing KIUC transmission line along Kaumualii Highway. The proposed connection route includes Tartar Drive and potentially Lighthouse Road pending additional land use agreement between U.S. Coast Guard and Navy. Both connection routes have existing 12.47 kV overhead electrical distribution lines. However, new poles would be required for the proposed 57 kV overhead transmission lines. These new transmission line utility poles would replace the existing distribution line poles, and both the proposed transmission lines (57 kV) and the existing distribution lines (12.47 kV) would be placed upon the new poles. Final siting would be subject to review by PMRF and KIUC personnel prior to construction. Right-of-way agreements would be negotiated with final siting of the transmission line; refer to Section 1.7.

2.3.2.3 Operation and Maintenance

The solar PV array would require minimal maintenance; however, occasional maintenance would be required for panel washing and panel replacement. If the amount of local rainfall is not sufficient to keep the panels clean, cleaning with hand tools or spray washing the surfaces of the PV panels with water would be undertaken periodically to remove accumulated dust and dirt. Water service to both

Site A and Site B would be metered and provided by connecting to an existing eight-inch water line which runs along Nohili Road. Water trucks may also be used for PV panel cleaning.

Periodic maintenance of the PV system electrical equipment would involve checking the equipment and testing the connections, replacing air filters in the inverters and sampling the oil in the transformers.

Maintenance for the BESS facility would involve checking the batteries and electrical equipment and testing the connections. A metered connection to an existing eight-inch water line which runs along Nohili Road may be made to provide water for fire protection of the BESS and substation complex.

Surface vegetation lying beneath, and adjacent to the panels, may be regularly trimmed to ensure that grass, plants and weeds do not overhang or cast shadows upon the panels. As warranted, herbicides may be used for vegetation control in accordance with applicable Navy regulations and manufacturer's guidelines. System access roads would be maintained to ensure vehicular access and mobility.

The new electrical transmission line would be maintained by either the developer or KIUC.

2.3.2.4 Lease Agreement

The land underlying the PV array, substation and BESS facilities would be leased to a third party for up to 40 years, including three years of construction. After the terms of the lease expire, the Navy may renew the lease or the facilities may be decommissioned. As a REPO "Model 2" project, the third-party would be responsible for constructing and operating the facilities, as well as selling the power to KIUC (the island-wide utility provider) or a private offtaker. The Navy would remain as a rate paying customer to KIUC. The Proposed Action would also not compete with residential rooftop PV grid access, as the intent is to utilize the BESS to discharge power to the KIUC grid in the evening/early morning hours, and not during daylight hours when residential solar systems are supplying power to the grid. The Navy would retain priority rights to the power generated and stored by the PV and BESS system to provide power to the base during contingency conditions.

In accordance with statutory requirements for the lease agreement, the Navy would receive in-kind consideration greater than or equal to the Government appraised fair market value for the leased property. This in-kind consideration would augment the energy resiliency at PMRF through surveys, analysis, studies, repair, replacement, or upgrades (or a combination thereof) of the electrical distribution system and/or controls for the distribution system to provide PMRF with access to renewable energy generation and/or battery energy storage system assets.

While the specific scope of the in-kind consideration would be determined through the lease negotiation process, it is anticipated that these activities would occur within the proposed project area or existing infrastructure or distribution system footprints. Details regarding the specific in-kind consideration to be employed, to include the design, construction, management and maintenance of any potential projects or efforts, have not been developed at this time. Therefore, these projects may be subject to further site-specific planning, environmental planning, and engineering analysis if necessary.

2.3.2.5 Removal of Equipment

If decommissioning is required, the developer would prepare a plan to decommission the PV system and supporting infrastructure. The plan would be prepared in accordance with Navy requirements and would ensure that the decommissioning of the site would be conducted in accordance with conditions established in the lease. In general, the decommissioning process would involve compliance with mutually agreed upon conditions for the removal of structures, restoration of topsoil and the re-

vegetation of the site. Best management practices (BMPs) would be used during the decommissioning phase to control soil erosion, sedimentation and stormwater runoff.

2.4 Alternatives Considered but not Carried Forward for Detailed Analysis

The following alternatives were considered, but not carried forward for detailed analysis in this EA as they did not meet the purpose and need for the project and satisfy the reasonable alternative screening factors presented in Section 2.2.

2.4.1 PMRF Site C

Site C is an approximately 57-acre site located to the north of the main entry gate of PMRF. This alternative was considered but is not being carried forward for detailed analysis in the EA because upon further review, it was determined that other facilities (administration and industrial expansion) are planned for this area under the PRMF Installation Development Plan (September 2016).

2.4.2 Other Renewable Energy Sources

The Navy evaluated other sources of renewable energy including wind, ocean currents and waves and geothermal resources, as alternatives to the Proposed Action (solar power). Wind turbines can interfere with airfield operations. Data from the Navy wave energy buoy test site in Hawaii shows that ocean energy technology is currently insufficiently developed to produce the targeted energy capacity. Geothermal, as a renewable energy source, is not currently feasible due to geologic constraints on Kauai, which no longer has magma reservoirs located directly beneath the island. These alternatives were considered but are not being carried forward for detailed analysis in the EA because Kauai experiences on average 240 days of full or partial sun, thus making solar power a reasonable and feasible alternative to satisfy the purpose and need of the Proposed Action.

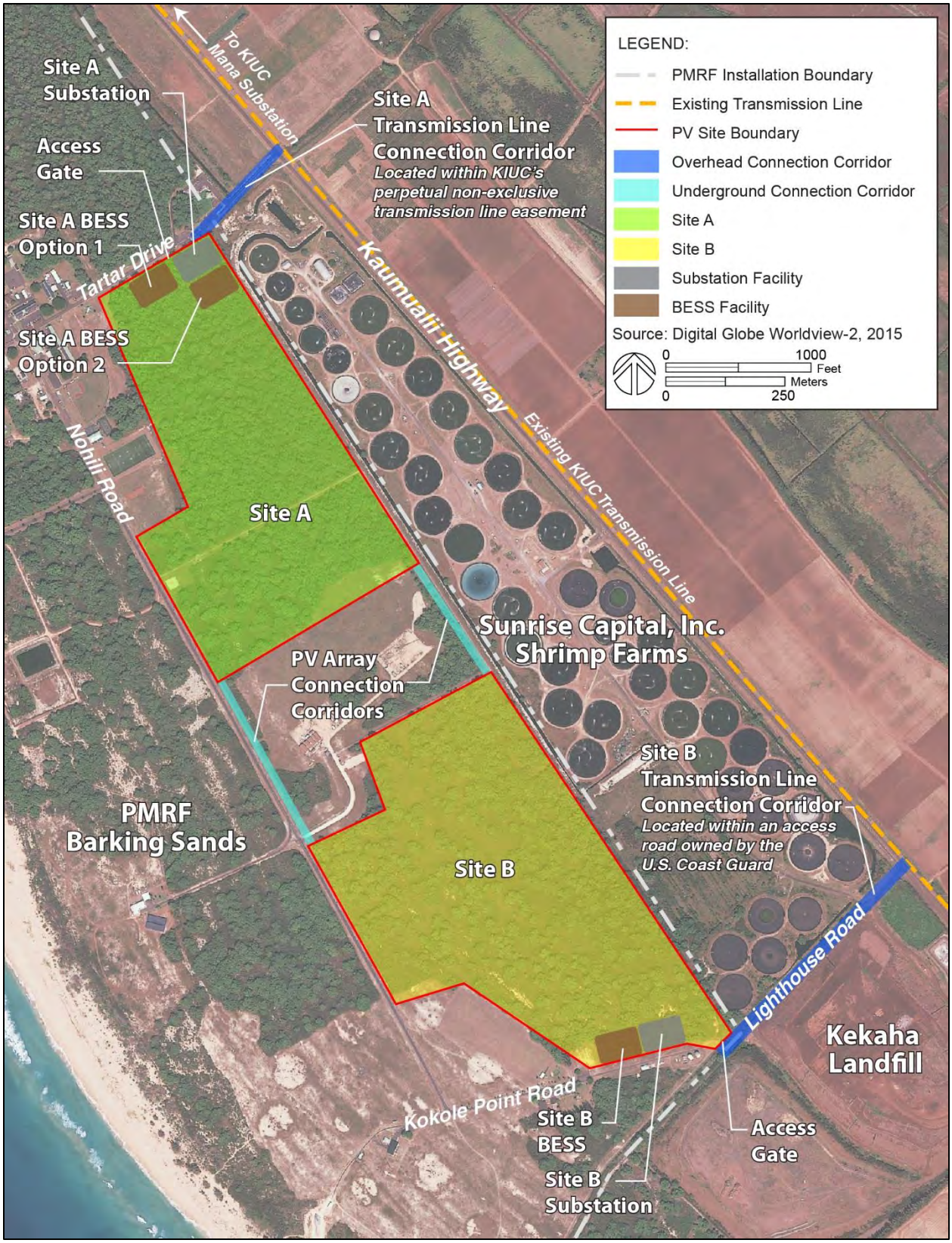


Figure 2-3 PMRF PV and BESS Site Map

3 Affected Environment and Environmental Consequences

This chapter presents a description of the environmental resources and baseline conditions that could be affected from implementing any of the alternatives and an analysis of the potential direct and indirect effects of each alternative.

All potentially relevant environmental resource areas were initially considered for analysis in this EA. In compliance with NEPA, CEQ, and 32 CFR part 775 guidelines, the discussion of the affected environment (i.e., existing conditions) focuses only on those resource areas potentially subject to impacts. Additionally, the level of detail used in describing a resource is commensurate with the anticipated level of potential environmental impact.

"Significantly," as used in NEPA, requires considerations of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole (e.g., human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of a Proposed Action. For instance, in the case of a site-specific action, significance would usually depend on the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant (40 CFR part 1508.27). Intensity refers to the severity or extent of the potential environmental impact, which can be thought of in terms of the potential amount of the likely change. In general, the more sensitive the context, the less intense a potential impact needs to be in order to be considered significant. Likewise, the less sensitive the context, the more intense a potential impact would be expected to be significant.

The project area is comprised of the 181 acres of land including Site A (approximately 87 acres) and Site B (approximately 94 acres). In addition to adjacent portions of Tartar Drive, Nohili Road, and Kokole Point Road, the project area also includes the proposed below grade power connection corridors between Sites A and B, as well as the potential transmission line connection corridors along Tartar Drive and Lighthouse Road from the PV site A and B substations to KIUC's existing 57kV transmission line along Kaumualii Highway (Figure 2-3).

This section evaluates the following resources within the general project area: air quality, water resources, geological resources, cultural resources, biological resources, land use, visual resources, airspace, noise, infrastructure, transportation, public health and safety, hazardous materials and wastes, and environmental justice.

Potential impacts to the following resources and resource components are considered negligible or non-existent and therefore, were not analyzed in detail in this EA.

Water Resources (marine waters, marine sediments): The Proposed Action is located approximately 0.5 mile from the shoreline at its closest point. Given its location, the Proposed Action is expected to have little effect on marine waters and sedimentation. Best Management Practices (BMPs) would be implemented to manage stormwater runoff and minimize soil loss and erosion during construction. The undeveloped lands that lie between the site and the shoreline also act as a buffer to intercept surface flows and minimize runoff into coastal waters.

Geological Resource (geology, bathymetry): The Proposed Action does not involve work that would affect geological characteristics or features such as bedrock material, mineral deposits, or fossil remains. In addition, the PV sites do not lie within a seismic hazard area with severe ground-shaking potential. The seismic zone classification for Kauai County is 1, meaning that in any given year within a 50-year period, there is a 0.075 percent chance that the force of gravity (ground acceleration) would be

exceeded during an earthquake (USGS, 2001). The Proposed Action does not involve work in coastal or inland waters and would not affect the topography of the sea floor or river bottom.

Biological Resources (marine species): The Proposed Action is located approximately 0.5 miles from the shoreline. Given its location, the Proposed Action is expected to have little effect on marine species. BMPs would be implemented to manage stormwater runoff and minimize soil loss and erosion during construction. The undeveloped lands that lie between the site and the shoreline also act as a buffer to intercept surface flows and minimize runoff into coastal waters.

Infrastructure (wastewater, communications): The Proposed Action would not disrupt existing wastewater or telecommunications services nor does it require the installation of sewer, cable, fiber optic, or phone lines or services.

Transportation (bus routes, bikeways, airports, harbors): Bus and bicycle transportation would not be affected by the Proposed Action nor would the proposed project have a direct effect on public airports or ocean transportation facilities. Most of the materials for the project would be imported by sea and trucked to the site. However, the volume of cargo passing through harbor facilities amounts to a fraction of their capacity and is well within their capabilities. Roadway traffic is covered in Section 3.11 (Transportation).

Socioeconomics: The Proposed Action is not expected to result in significant socioeconomic impacts because it would not alter population and demographic characteristics nor would it result in inconsistent population growth or have disproportionate impacts upon housing and employment markets. Construction-related employment would have a positive impact on the local economy due to spending by those employed in project-related construction jobs and businesses providing goods and services to the construction industry. Construction-related spending would also benefit businesses in other commercial sectors (e.g., stores, restaurants), while construction-related tax revenues would benefit the local economy. During the operational period, the PV systems would continue contributing to the local economy through the payment of wages and the purchase of goods and services for the operation and maintenance of the system. By reducing KIUC's dependence on fossil fuels for energy production, the PV systems would help to stabilize, and likely reduce energy rates for the Kauai community.

Environmental Justice: Executive Order 12898 (February 11, 1994), and SECNAVs Notice 5090 (May 27, 1994) requires the Navy to identify and address the potential for disproportionately high and adverse human health and environmental effects of their actions on minority and low-income populations. Because the PV systems would be located on DoD property, exposure and risk to the general public would be limited. In addition, since the Proposed Action is not expected to have a significant impact upon environmental resources, it would not create environmental health or safety risks that would disproportionately affect minorities or disadvantaged populations. The construction and operation of the PV systems would not disrupt the structure or cohesion of the community since the Proposed Action would occur on DoD lands. The Proposed Action would not affect environmental justice factors because there would be no significant changes in land use or aesthetics and there would be no disproportionate human health or environmental impacts to low income or minority populations.

3.1 Air Quality

This discussion of air quality includes criteria pollutants, standards, sources, permitting and greenhouse gases. Air quality in a given location is defined by the concentration of various pollutants in the atmosphere. A region's air quality is influenced by many factors including the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions.

Most air pollutants originate from man-made sources, including mobile sources (e.g., cars, trucks, buses) and stationary sources (e.g., factories, refineries, power plants), as well as indoor sources (e.g., some building materials and cleaning solvents). Air pollutants are also released from natural sources such as volcanic eruptions and forest fires.

3.1.1 Regulatory Setting

Criteria Pollutants and National Ambient Air Quality Standards

The principal pollutants defining the air quality, called "criteria pollutants," include carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone, suspended particulate matter less than or equal to 10 microns in diameter (PM_{10}), fine particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). CO, SO_2, Pb, and some particulates are emitted directly into the atmosphere from emissions sources. Ozone, NO_2, and some particulates are formed through atmospheric chemical reactions that are influenced by weather, ultraviolet light, and other atmospheric processes.

Under the Clean Air Act (CAA), the U.S. Environmental Protection Agency (USEPA) has established National Ambient Air Quality Standards (NAAQS) (40 CFR part 50) for these pollutants. NAAQS are classified as primary or secondary. Primary standards protect against adverse health effects; secondary standards protect against welfare effects, such as damage to farm crops and vegetation and damage to buildings. Some pollutants have long-term and short-term standards. Short-term standards are designed to protect against acute, or short-term, health effects, while long-term standards were established to protect against chronic health effects.

Areas that are and have historically been in compliance with the NAAQS are designated as attainment areas. Areas that violate a federal air quality standard are designated as nonattainment areas. Areas that have transitioned from nonattainment to attainment are designated as maintenance areas and are required to adhere to maintenance plans to ensure continued attainment.

The CAA requires states to develop a general plan to attain and maintain the NAAQS in all areas of the country and a specific plan to attain the standards for each area designated nonattainment for a NAAQS. These plans, known as State Implementation Plans (SIPs), are developed by state and local air quality management agencies and submitted to USEPA for approval.

General Conformity

The USEPA General Conformity Rule applies to federal actions occurring in nonattainment or maintenance areas when the total direct and indirect emissions of nonattainment pollutants (or their precursors) exceed specified thresholds. The emissions thresholds that trigger requirements for a conformity analysis are called de minimis levels. De minimis levels (in tons per year [tpy]) vary by pollutant and also depend on the severity of the nonattainment status for the air quality management area in question.

Permitting

New Source Review (Preconstruction Permit)

New major stationary sources and major modifications at existing major stationary sources are required by the CAA to obtain an air pollution permit before commencing construction. This permitting process for major stationary sources is called New Source Review and is required whether the major source or major modification is planned for nonattainment areas or attainment and unclassifiable areas.

Title V (Operating Permit)

The Title V Operating Permit Program consolidates all CAA requirements applicable to the operation of a source, including requirements from the SIP, preconstruction permits, and the air toxics program. It applies to stationary sources of air pollution that exceed the major stationary source emission thresholds, as well as other non-major sources specified in a particular regulation.

Greenhouse Gases

GHGs are gas emissions that trap heat in the atmosphere. These emissions occur from natural processes and human activities. Scientific evidence indicates a trend of increasing global temperature over the past century due to an increase in GHG emissions from human activities. The climate change associated with this global warming is predicted to produce negative economic and social consequences across the globe.

Final guidance from CEQ, dated August 1, 2016, recommends that agencies consider both the potential effects of a Proposed Action on climate change, as indicated by its estimated greenhouse gas emissions, and the implications of climate change for the environmental effects of a Proposed Action. The guidance also emphasizes that agency analyses should be commensurate with projected greenhouse gas emissions and climate impacts, and should employ appropriate quantitative or qualitative analytical methods to ensure useful information is available to inform the public and the decision-making process in distinguishing between alternatives and mitigations. It recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions.

The USEPA issued the Final *Mandatory Reporting of Greenhouse Gases Rule* on September 22, 2009. GHGs covered under the Final *Mandatory Reporting of Greenhouse Gases Rule* are carbon dioxide (CO_2), methane, nitrogen oxide (NO_x), hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and other fluorinated gases including nitrogen trifluoride and hydrofluorinated ethers. Each GHG is assigned a global warming potential. The global warming potential is the ability of a gas or aerosol to trap heat in the atmosphere. The global warming potential rating system is standardized to CO_2, which has a value of one. The equivalent CO_2 rate is calculated by multiplying the emissions of each GHG by its global warming potential and adding the results together to produce a single, combined emissions rate representing all GHGs. Under the rule, suppliers of fossil fuels or industrial GHGs, manufacturers of mobile sources and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions as CO_2e are required to submit annual reports to USEPA.

In an effort to reduce energy consumption, reduce GHGs, reduce dependence on petroleum, and increase the use of renewable energy resources the Navy has implemented a number of renewable energy projects. The Navy has established Fiscal Year 2020 GHG emissions reduction targets of 34 percent from a FY 2008 baseline for direct GHG emissions and 13.5 percent for indirect emissions. Examples of Navy-wide GHG reduction projects include energy efficient construction, thermal and

photovoltaic solar systems, geothermal power plants, and the generation of electricity with wind energy. The Navy continues to promote and install new renewable energy projects.

3.1.2 Affected Environment

PMRF-Barking Sands is in Kauai County, which is within the State of Hawaii Air Quality Control Region. The Clean Air Branch of the Hawaii Department of Health is responsible for implementing and enforcing state and federal air quality regulations in Hawaii. All of Hawaii is classified by the USEPA as unclassified/attainment for all criteria pollutants. Therefore a General Conformity evaluation is not required.

The most recent emissions inventory for Kauai County is shown in Table 3-1. VOC and NOx emissions are used to represent ozone generation because they are precursors of ozone.

Table 3-1 County Air Emissions Inventory (2011)

	NO_x (tpy)	*VOC (tpy)*	*CO (tpy)*	*SO_2 (tpy)*	*PM_{10} (tpy)*	*$PM_{2.5}$ (tpy)*
Kauai County	3,745	2,762	14,076	335	4,547	1,040
Source: EPA 2013 Key: tpy = tons per year.						

PMRF-Barking Sands operates under a covered source permit (0110-01-C) issued by the Hawaii Department of Health. Permitted sources include five diesel electric generators.

3.1.3 Environmental Consequences

Effects on air quality are based on estimated direct and indirect emissions associated with the action alternatives. The region of influence (ROI) for assessing air quality impacts is the air basin in which the project is located, the State of Hawaii.

Estimated emissions from a proposed federal action are typically compared with the relevant national and state standards to assess the potential for increases in pollutant concentrations.

3.1.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and PMRF would continue to consume electrical energy generated from fossil fuels. Therefore, the negative impacts of fossil fuel energy generation on air resources would continue with implementation of the No Action Alternative.

3.1.3.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The Proposed Action would not introduce new major air emissions sources or stationary air emissions sources. The ambient air quality at the proposed PV sites are within the Hawaii and NAAQS. During the construction phase, emissions from heavy equipment (e.g., bulldozers, excavators, dump trucks, etc.) would temporarily affect ambient air quality. In addition, ground disturbing activities such as site clearing; grading for the foundations of the PV system components, and maintenance roads; and trenching for fence posts, utility poles, and underground utility lines would temporarily generate fugitive dust. To minimize the effects of fugitive dust during construction, dust suppression methods using water trucks and dust screens would be implemented in accordance with applicable regulatory requirements.

Construction of the Proposed Action is expected to result in short-term, less than significant impacts to air quality.

General Conformity

Because the State of Hawaii is in attainment of the NAAQS, the Proposed Action is not subject to the Clean Air Act's General Conformity Rule. The Proposed Action would not involve new major stationary air emissions sources or major modifications to existing stationary sources.

Greenhouse Gases

Construction of the Proposed Action would result in an increase in greenhouse gas emissions. This increase would be attributed primarily to diesel-powered equipment and trucks, along with fossil fuel-powered delivery trucks and vehicles of workers traveling to and from the PV sites. However, this construction period increase in GHG emissions would be temporary. GHG emissions estimates for the construction of similar sized ground-mount PV projects suggest that the GHG emissions associated with the construction of the Proposed Action would be in the range of 3,000 metric tons of carbon dioxide equivalent ($MTCO_2e$)[1]. These emissions would be spread over the three year duration of construction for estimated emissions of 1,000 $MTCO_2e$ per year of construction.

During the operational period, none of the PV system components emit air pollutants of any kind. Some emissions would result from vehicles travelling to and from the PV sites for periodic maintenance but these effects would involve relatively short distances and brief periods of time. The renewable energy generated by the proposed PV systems would reduce dependence on energy generated from the burning of fossil fuels, including the energy currently provided by diesel generators located at PMRF. GHG emissions reductions are estimated at 24,927 $MTCO_2e$ per year of operations[2]. The GHG emissions reduction associated with renewable energy generated by the Proposed Action would greatly outweigh the initial increase in GHG emissions associated with construction. The Proposed Action would provide long-term beneficial impact on air quality and GHG emissions.

During the decommissioning process, dust from the removal of structures and improvements and an increase in emissions from vehicles and equipment used to perform this work would temporarily affect air quality. However, BMPs would be implemented to control fugitive dust, and this the increase in emissions would be limited in duration. GHG emissions estimates for the decommissioning of similar sized ground-mount PV projects suggest that the GHG emissions associated with the decommissioning of the Proposed Action would be in the range of 180 $MTCO_2e$[3]. Decommissioning is estimated to last no more than one year.

Therefore, implementation of the Proposed Action would not result in significant impacts to air quality.

[1] GHG emissions were estimated at 3,069 $MTCO_2e$ for the construction of a 194 acre PV project at Camp Pendleton (Navy, 2015)
[2] GHG emissions reductions were calculated using the EPA's Prevention Program's Greenhouse Gas Calculator, https://www.epa.gov/sites/production/files/2015-07/**ghg**conversion.xls
[3] GHG emissions were estimated at 182 $MTCO_2e$ for the decommissioning of a 194 acre PV project at Camp Pendleton (Navy, 2015)

3.2 Water Resources

This discussion of water resources focuses on the following components: groundwater, surface water, wetlands, and floodplains. Marine waters and marine sediments were not included in this analysis as discussed on Page 3-1.

Groundwater is water that flows or seeps downward and saturates soil or rock, supplying springs and wells.

Surface water resources generally consist of wetlands, lakes, rivers, and streams. Surface water is important for its contributions to the economic, ecological, recreational, and human health of a community or locale. A Total Maximum Daily Load (TMDL) is the maximum amount of a substance that can be assimilated by a water body without causing impairment. A water body can be deemed impaired if water quality analyses conclude that exceedances of water quality standards occur.

Wetlands are jointly defined by USEPA and United States Army Corps of Engineers (USACE) as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands generally include "swamps, marshes, bogs and similar areas".

Floodplains are areas of low-level ground present along rivers, stream channels, large wetlands, or coastal waters. Floodplain ecosystem functions include natural moderation of floods, flood storage and conveyance, groundwater recharge, and nutrient cycling. Floodplains also help to maintain water quality and are often home to a diverse array of plants and animals. In their natural vegetated state, floodplains slow the rate at which the incoming overland flow reaches the main water body. Floodplain boundaries are most often defined in terms of frequency of inundation, that is, the 100-year and 500-year flood. Floodplain delineation maps are produced by the Federal Emergency Management Agency and provide a basis for comparing the locale of the Proposed Action to the floodplains.

Sediments are the solid fragments of organic and inorganic matter created from weathering rock transported by water, wind, and ice (glaciers) and deposited at the bottom of bodies of water. Components of sediment range in size from boulders, cobble, and gravel to sand (particles 0.05 to 2.0 millimeters [mm] in diameter), silt (0.002 to 0.05 mm), and clay (less than or equal to 0.002 mm). Sediment deposited on the continental shelf is delivered mostly by rivers but also by local and regional currents and wind. Most sediment in nearshore areas and on the continental shelf is aluminum silicate derived from rocks on land that is deposited at rates of greater than ten centimeters per 1,000 years. Sediment may also be produced locally as nonliving particulate organic material ("detritus") that travels to the bottom (Hollister, 1973; Milliman et al., 1972). Some areas of the deep ocean contain an accumulation of the shells of marine microbes composed of silicon and calcium carbonate, termed biogenic ooze (Chester, 2003). Through the downward movement of organic and inorganic particles in the water column, substances that are otherwise scarce in the water column (e.g., metals) are concentrated in bottom sediment (Chapman et al., 2003; Kszos et al., 2003).

3.2.1 Regulatory Setting

Groundwater quality and quantity are regulated under several statutes and regulations, including the Safe Drinking Water Act.

The Clean Water Act (CWA) establishes federal limits, through the National Pollutant Discharge Elimination System (NPDES) program, on the amounts of specific pollutants that can be discharged into surface waters to restore and maintain the chemical, physical, and biological integrity of the water. The NPDES program regulates the discharge of point (i.e., end of pipe) and nonpoint sources (i.e., stormwater) of water pollution.

Waters of the United States are defined as (1) traditional navigable waters, (2)wetlands adjacent to navigable waters, (3) non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow perennially or have continuous flow at least seasonally (e.g., typically 3 months), and (4) wetlands that directly abut such tributaries under Section 404 of the CWA, as amended, and are regulated by USEPA and the U.S. Army Corps of Engineers (USACE). The CWA requires that Hawaii establish a Section 303(d) list to identify impaired waters and establish TMDLs for the sources causing the impairment.

Section 438 of the Energy Independence and Security Act establishes stormwater design requirements for development and redevelopment projects. Under these requirements, federal facility projects larger than 5,000 square feet must "maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow."

The Hawaii NPDES stormwater program requires construction site operators engaged in clearing, grading, and excavating activities that disturb one acre or more to obtain coverage under an NPDES Construction General Permit for stormwater discharges. Construction or demolition that necessitates an individual permit also requires preparation of a Notice of Intent to discharge stormwater and a Stormwater Pollution Prevention Plan that is implemented during construction. As part of the 2010 Final Rule for the CWA, titled *Effluent Limitations Guidelines and Standards for the Construction and Development Point Source Category*, activities covered by this permit must implement non-numeric erosion and sediment controls and pollution prevention measures.

Wetlands are currently regulated by the USACE under Section 404 of the CWA as a subset of all "Waters of the United States." The term "Waters of the United States" has a broad meaning under the CWA and incorporates deep water aquatic habitats and special aquatic habitats, including wetlands. Jurisdictional Waters of the United States regulated under the CWA include coastal and inland waters, lakes, rivers, ponds, streams, intermittent streams, and "other" waters that, if degraded or destroyed, could affect interstate commerce. The full regulatory definition of Waters of the United States is provided in the Clean Water Act.

Executive Order 11990, *Protection of Wetlands,* requires that federal agencies adopt a policy to avoid, to the extent possible, long- and short-term adverse impacts associated with destruction and modification of wetlands and to avoid the direct and indirect support of new construction in wetlands whenever there is a practicable alternative.

Section 404 of the CWA authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredge or fill into wetlands and other Waters of the United States. Any discharge of dredge or fill into Waters of the United States requires a permit from the USACE.

Section 10 of the Rivers and Harbors Act provides for USACE permit requirements for any in-water construction. USACE and some states require a permit for any in-water construction. Permits are required for construction of piers, wharfs, bulkheads, pilings, marinas, docks, ramps, floats, moorings, and like structures; construction of wires and cables over the water, and pipes, cables, or tunnels under

the water; dredging and excavation; any obstruction or alteration of navigable waters; depositing fill and dredged material; filling of wetlands adjacent or contiguous to waters of the U.S.; construction of riprap, revetments, groins, breakwaters, and levees; and transportation of dredged material for dumping into ocean waters.

Executive Order 11988, *Floodplain Management*, requires federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development unless it is the only practicable alternative. Flood potential of a site is usually determined by the 100-year floodplain, which is defined as the area that has a one percent chance of inundation by a flood event in a given year.

The Coastal Zone Management Act of 1972 (CZMA) provides assistance to states, in cooperation with federal and local agencies, for developing land and water use programs in coastal zones. Section 307 of the CZMA stipulates that where a federal project initiates reasonably foreseeable effects to any coastal use or resource (land or water use, or natural resource), the action must be consistent to the maximum extent practicable with the enforceable policies of the affected state's federally approved coastal management plan. The Hawaii State Office of Planning (OP) is the lead agency for coastal management and is responsible for enforcing the State's federally approved coastal management plan. However, Federal lands, which are "lands the use of which is by law subject solely to the discretion of…the Federal Government, its officers, or agents," are statutorily excluded from the State's "coastal zone". If, however, the proposed federal activity affects coastal resources or uses beyond the boundaries of the federal property (i.e., has spillover effects), the CZMA Section 307 federal consistency requirement applies. As a federal agency, the Navy is required to determine whether its proposed activities would affect the coastal zone. This takes the form of either a Negative Determination or a Consistency Determination.

3.2.2 Affected Environment

The following discussions provide a description of the existing conditions for each of the components under water quality resources at the project area.

3.2.2.1 Groundwater

The project area lies over a sedimentary caprock aquifer that rests on a primary basalt aquifer within the Kekaha aquifer system of the Waimea sector. The upper aquifer is unconfined basal water in sedimentary caprock. It is moderate in salinity, has potential for use, and is irreplaceable[4] and highly vulnerable to contamination. The lower aquifer is confined basal water in rift zones characterized by dikes. It is low in salinity, a potential drinking water source, replaceable[5] and slightly vulnerable to contamination (Mink & Lau, 1992) (Mink & Lau, 1990).

[4] The EPA Guidelines for Groundwater Classification (1988) defines groundwater as irreplaceable "if it would be economically infeasible to develop an alternative water-supply source of comparable quality and quantity in the area, or if delivery from an already existing alternate source is precluded by institutional constraints or transport distance."

[5] Replaceable groundwater refers to groundwater that is not classified as "irreplaceable."

3.2.2.2 Surface Waters

The Mana Plain was originally a vast swamp, but it has been artificially drained by a network of pumps and ditches to allow for agricultural use (Mink & Lau, 1992). Surface waters within Barking Sands are largely concentrated in the drainage ditches that convey runoff from agricultural areas east of the base. Two of the ditches, the Kinikini Ditch and the Nohili Ditch, transect the base and connect to the ocean, and are also used for stormwater discharge from the Mana Plain (CNRH, 2010). The Kinikini Ditch and Nohili Ditch are located approximately 1.6 miles and 3.8 miles to the northwest of the project site, respectively. The water levels and salinity in the ditches is influenced by ocean tides, wave action, and freshwater pumped from the Mana Plain (Navy, 2009). Surface waters in the project vicinity are located at the Sunrise Shrimp Farm which lies east of, and adjacent to the PV site (Figure 2-3). The shrimp farm utilizes a system of man-made ponds and canals for its operations. Earthen berms border both sides of the approximately 30-foot wide canal that lies between the PV sites and the shrimp farm. Surface runoff on the installation is absorbed by the surrounding ground area and is aided by low building density and vegetated areas on the base that enhance absorption.

3.2.2.3 Wetlands

There are no known, jurisdictional, or naturally-occurring wetlands within the project site (CNRH, 2010). Several man-made oxidation ponds and irrigation ditches at PMRF-Barking Sands support protected bird species, but there have been no USACE wetland delineations and none of these ponds or ditches are located within the project site. To the east of the site, the USFWS National Wetlands Inventory (NWI) identifies several freshwater ponds including the man-made ponds and canals at the Sunrise Shrimp Farm, and several seed corn fields. Other seed corn fields are identified by the NWI as freshwater emergent wetlands. The 39-acre Kawaiele Bird Sanctuary is located approximately 0.6 miles north of the project area. It was created in the 1990s by removing sand to the ground water level, and it now serves as habitat for endemic and endangered water birds, including the Hawaiian stilt (*Himantopus mexicanus knudseni*), the Hawaiian moorhen (*Gallinula chloropus sanvicensis*) and the Hawaiian duck (*Anas wyvilliana*).

3.2.2.4 Floodplains

The primary flood hazard at PMRF-Barking Sands is from the overflow of the Kinikini and Nohili Ditches and extended periods of heavy rainfall that have resulted in minor flooding of low-lying areas (CNRH, 2010). The agricultural areas of the Mana Plain use a system of pumps to control flooding on lands that drain into the Nohili Ditch (Navy, 2009).

The Flood Insurance Rate Maps (FIRM) produced by the Federal Emergency Management Agency indicates that the PV sites are located in Zone X, areas determined to be outside the 0.2 percent annual chance floodplain (DLNR, 2010).

The entire PMRF-Barking Sands Installation, including the project site, is located within the Tsunami Evacuation Zone. Individuals in an evacuation zone must be prepared to move inland to higher ground or seek refuge at a Public Emergency Shelter in the area when emergency sirens sound (Pacific Disaster Center, 2016). Kauai Civil Defense evacuation shelters in proximity to PMRF-Barking Sands are southeast of the base and located at Kekaha Elementary School (2.4 miles), Waimea Canyon Middle School (5.2 miles), and Waimea High School (5.6 miles).

3.2.3 Environmental Consequences

The following discussion of water resources evaluates potential impacts to groundwater, surface water, wetlands, and floodplains in relation to the Proposed Action.

3.2.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline water resources. Therefore, no significant impacts to water resources would occur with implementation of the No Action Alternative.

3.2.3.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

During construction of the Proposed Action, water would be dispensed by water trucks or temporary irrigation systems to control fugitive dust and wet down exposed ground. Creation and use of construction staging and work areas would involve ground disturbance, which has the potential to result in temporary impacts such as sediments or pollutants being transported to surface waters. However, construction period BMPs and compliance with required permits such as a National Pollutant Discharge Elimination System (NPDES) permit would avoid or minimize potential impacts to offsite stormwater receiving waters. Proper storage of hazardous materials and immediate cleanup of leaks or spills would be implemented to prevent contamination of groundwater resources.

In the operational period, water service for cleaning and maintenance purposes would be provided by connecting the PV sites to an existing 8-inch, below grade water line in Nohili Road. The PV panels may be periodically washed with clean water to remove accumulated dust and debris to prevent a reduction in panel efficiency and energy production. Washing of the PV arrays will depend on local weather conditions. Sufficient rainfall will passively clean the PV panels and requires little to no additional active washing. During dry dusty periods, the PV array may need to be washed. The proposed PV arrays would likely require washing from one to four times per year depending on local weather conditions. Apart from operations and maintenance activities, the PV systems would be unmanned and would not require potable water usage. The water utilized for construction, operations, and maintenance purposes would have negligible effects on groundwater withdrawals and recharge. While small amounts of hazardous materials may be contained within equipment like the inverters, transformers, and BESS, they are housed in closed, properly-maintained systems. During construction, BMPs such as proper storage of hazardous materials and immediate cleanup of leaks or spills would be implemented to prevent contamination of groundwater resources.

Section 438 of the Energy Independence and Security Act (EISA) of 2007 established strict stormwater runoff requirements for federal development and re-development projects with a footprint greater than 5,000 square feet in order to maintain or restore the pre-development hydrology of the property with regard to temperature, rate, volume, and duration of flow, to the maximum extent practicable. The PV sites are currently covered with non-native *kiawe* trees (*prosopis pallida*) and scrub vegetation. The installation of PV ground mount system on the site would increase the amount of impervious surface. However, the increase in runoff would be minor as the increase in impervious surface would be limited to the footprint of the ground-mounted PV footings or posts, and equipment foundations which is estimated at less than 10 percent of the total site area. As required by EISA Section 438, BMPs would be implemented to capture and retain stormwater on site and allow it to infiltrate into the soil or be discharged at a rate that would not exceed pre-development surface flows to downstream surface

waters. Since construction activities would exceed one acre, a National Pollutant Discharge Elimination System (NPDES) permit would be obtained for the proposed project.

The Proposed Action would not result in the destruction or modification of, or new construction in, known wetlands. There are no known, jurisdictional, or naturally-occurring wetlands within the project site (CNRH, 2010).

Because the project site lies within Zone X, an area outside the 0.2 percent annual chance floodplain, the Proposed Action is not subject to the provisions of Executive Order (EO) 11988, *Floodplain Management*, which requires federal agencies to avoid short and long-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development unless it is the only practicable alternative. In addition, the PV systems would be unmanned facilities and would not be subject to evacuation when a tsunami warning is issued.

During the decommissioning process, the removal of the PV system components would require ground disturbance. However, similar to construction period requirements, BMPs would be implemented during decommissioning to control soil erosion, sedimentation, and stormwater to ensure that the removal of structures and improvements does not impact surface or ground water.

Therefore, implementation of the Proposed Action would not result in significant impacts to water resources.

3.3 Geological Resources

This discussion of geological resources focuses on the following components: topography and soils. Geology and bathymetry are not included in this analysis as discussed on Page 3-1 and Page 3-2, respectively. Topography is typically described with respect to the elevation, slope, and surface features found within a given area. The geology of an area may include bedrock materials, mineral deposits, and fossil remains. The principal geological factors influencing the stability of structures are soil stability and seismic properties. Soil refers to unconsolidated earthen materials overlying bedrock or other parent material. Soil structure, elasticity, strength, shrink-swell potential, and erodibility determine the ability for the ground to support structures and facilities. Soils are typically described in terms of their type, slope, physical characteristics, and relative compatibility or limitations with regard to particular construction activities and types of land use.

3.3.1 Affected Environment

The following discussions provide a description of the existing conditions for each of the categories under geological resources at PMRF-Barking Sands.

3.3.1.1 Topography

Kauai was formed by a massive shield volcano 5.1 million years ago, and is part of a chain of similar volcanoes that created the Hawaiian archipelago. Kauai is the northern most and oldest of the eight main Hawaiian Islands, and has a maximum elevation of 5,243 feet at Kawaikini, the summit of Mount Waialeale (Navy, 2016).

PMRF-Barking Sands is a low-lying coastal terrace on the western side of Kauai. The Mana Plain bounds the western flank of the island, forming gentle westerly slopes near the volcanic upland and relatively flat sandy land at the coastal margin. The Mana Plain is approximately 15 feet above mean sea level

(AMSL). Low beach barrier dunes, mildly undulating sands, and the more prominent Nohili Dunes located at the northern end of PMRF-Barking Sands provide some local elevation (Navy, 2009).

The PV sites are relatively flat and covered with scrub vegetation and *kiawe* trees ranging from 30 to 40 feet in height. An approximately 30-foot wide canal separates much of the PV sites from the Sunrise Shrimp Farm which is east of, and adjacent to, the PV sites. The ground surface is relatively flat in the project area with a range from approximately 10 feet to 20 feet AMSL

3.3.1.2 Soils

According to the U.S. Department of Agriculture's Soil Conservation Service, the dominant soil type within PMRF-Barking Sands is Jaucas loamy fine sand, with 0 to 8 percent slopes. This soil is described as occurring on old beaches and on windblown sand deposits. It is pale brown and, in some cases, more than 5 feet deep. In many places, the surface layer is dark brown as a result of accumulated organic matter and alluvium. The silt is neutral to moderately alkaline through its profile, containing soils that are permeable with rapid infiltration (Department of the Navy, 2009) (DoN, 2009).

3.3.2 Environmental Consequences

The following discussion of geological resources evaluates potential impacts to topography and soils in relation to the Proposed Action.

3.3.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to topography or soils. Therefore, no significant impacts to geological resources would occur with implementation of the No Action Alternative.

3.3.2.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The study area encompasses the proposed construction and ground disturbance areas related to the Proposed Action. During construction, site preparation would involve selective grading, grubbing, and vegetation removal in areas where the PV arrays, substation complex, and maintenance roads would be located. Earthwork and ground disturbance would be required for the construction of maintenance roads, fence posts, utility poles, underground utility lines, and the foundations of the PV system components. The installation of below grade conduit or utility poles to support the new transmission lines would require ground disturbance along Tartar Drive and Lighthouse Road to connect the PV substations on Site A and Site B to KIUC's existing 57kV transmission line along Kaumualii Highway. The new utility poles may replace or be installed next to the existing utility poles. Cut and fill quantities would be balanced on site to make use of excavated earth although not all of this material may be suitable for structural fill. As necessary, the contractor may need to import appropriate fill material (e.g., gravel, rock, sand) to create a strong and stable foundation for PV system components.

Ground-altering construction activities would comply with all applicable regulatory requirements. An NPDES Permit would be obtained from the Hawaii Department of Health for the discharge of stormwater associated with construction activities such as grubbing and grading. To the extent possible, earthwork would be balanced to maintain existing drainage patterns. The contractor would be responsible for implementing BMPs to control soil erosion and sedimentation during construction activities.

During the operational period, no ground disturbing activities will be required to operate or maintain the PV systems. Maintenance vehicles will travel along defined access roadways, and runoff from the washing of the PV arrays will be absorbed by the surrounding pervious ground surface. Operations and maintenance of the PV systems is not expected to impact geological resources.

During the decommissioning process, the removal of the PV system components would require ground disturbance. However, similar to construction period requirements, BMPs would be implemented during decommissioning to control soil erosion, sedimentation, and stormwater runoff.

Therefore, implementation of the Proposed Action would not result in significant impacts to geological resources.

3.4 Cultural Resources

This discussion of cultural resources focuses on prehistoric and historic archaeological sites and man-made or natural features important to a culture, a subculture, or a community for traditional, religious, or other reasons. The discussion of cultural resources can be divided into the following categories:

- Archaeological resources (prehistoric and historic) are locations where human activity measurably altered the earth or left deposits of physical remains.
- Architectural resources include standing buildings, structures, landscapes, and other built-environment resources of historic or aesthetic significance.
- Traditional cultural properties may include archaeological resources, structures, neighborhoods, prominent topographic features, habitat, plants, animals, and minerals that Native Hawaiians or other groups consider essential for the preservation of traditional culture.

3.4.1 Regulatory Setting

Cultural resources are governed by other federal laws and regulations, including the National Historic Preservation Act (NHPA), Archeological and Historic Preservation Act, American Indian Religious Freedom Act, Archaeological Resources Protection Act of 1979, and the Native American Graves Protection and Repatriation Act of 1990. Federal agencies' responsibility for protecting historic properties is defined primarily by sections 106 and 110 of the NHPA. Section 106 requires federal agencies to take into account the effects of their undertakings on historic properties. Section 110 of the NHPA requires federal agencies to establish—in conjunction with the Secretary of the Interior—historic preservation programs for the identification, evaluation, and protection of historic properties. Cultural resources also may be covered by state, local, and territorial laws.

When routine or repetitive actions are likely to affect potential NRHP-eligible resources, a Programmatic Agreement (PA) is developed in consultation with the State Historic Preservation Office (SHPO), the Office of Hawaiian Affairs (OHA), Native Hawaiian organizations (NHOs), and the Advisory Council on Historic Preservation (ACHP). The development of the PA allows for consideration of the effects of repetitive actions to potentially eligible resources through a planned approach to the completion of these tasks. In 2003, a PA among the Commander Naval Region Hawaii (CNRH), ACHP, and SHPO was signed regarding all Navy undertakings in Hawaii, whether they are initiated by CNRH, another command, or lessee. The PA is broad in scope and covers a variety of Navy undertakings at all their installations including, but not limited to, the dredging of its harbors; the maintenance, rehabilitation, repair, construction, and demolition of buildings, structures, and roads; and work regarding grounds and associated landscaping within the State of Hawaii. The Proposed Action will be primarily located on land

within PMRF-Barking Sands which is included in the 2003 PA. However, the two overhead transmission line connection corridors Tartar Drive and Lighthouse Road are located on lands owned by the State of Hawaii and the U.S. Coast Guard respectively, and therefore are not included in this PA.

3.4.2 Affected Environment

Cultural resources that are listed in the NRHP or eligible for listing in the National Register of Historic Places (NRHP) are "historic properties" as defined by the NHPA. The list was established under the NHPA and is administered by the National Park Service on behalf of the Secretary of the Interior. The NRHP includes properties on public and private land. Properties can be determined eligible for listing in the NRHP by the Secretary of the Interior or by a federal agency official with concurrence from the applicable SHPO. A NRHP-eligible property has the same protections as a property listed in the NRHP. The historical properties include archaeological and architectural resources.

The Navy has conducted inventories of cultural resources at PMRF, including the project area, to identify historical properties that are listed or potentially eligible for listing in the NRHP.

The area of potential effect (APE) for cultural resources is the geographic area or areas within which an undertaking (project, activity, program or practice) may cause changes in the character or use of any historic properties present. The APE is influenced by the scale and nature of the undertaking and may be different for various kinds of effects caused by the undertaking. For the Proposed Action, the Navy determined that the APE is defined by the 181 acres of land occupied by Site A (approximately 87 acres) and Site B (approximately 94 acres). In addition, the APE includes the portions of Tartar Drive, Nohili Road, and Kokole Point Road that abut the proposed PV sites, as well as the proposed subsurface power connection corridors between Sites A and B and the overhead transmission line connection corridors along Tartar Drive and Lighthouse Road.

3.4.2.1 Archaeological Resources

Archaeological sites have been documented along the coast and inland from PMRF-Barking Sands that indicate habitation, religious, and agricultural activities dating from the 12th century through the present. Based on previous archaeological research within PMRF-Barking Sands, the possible presence of traditional cultural materials or burials was anticipated in the region between the shoreline-back beach and coastal dunes. However, it appears that traditional Hawaiian use from the shoreline to the marshland was minimal. Traditional Hawaiian use of the zone inland of the coastal berms appears extremely limited, with the greatest use apparently along shoreline dunes. The most intensive modifications occurred from historical agricultural use, military development, and road construction.

The APE for the PV sites A and B is located within the back beach area extending from Kawaiele Ditch to Kokole Point. There are no known archaeological resources identified within the APE for PV sites A and B. Both locations are within areas that have been determined to have low potential for archaeological resources. Archaeological studies conducted by Wulzen et al (1997), Walker and Rosendahl (1990), NAVFAC Pacific (PACDIV 2002), and Clark et al (2015) have documented previous disturbance and found no archaeological resources.

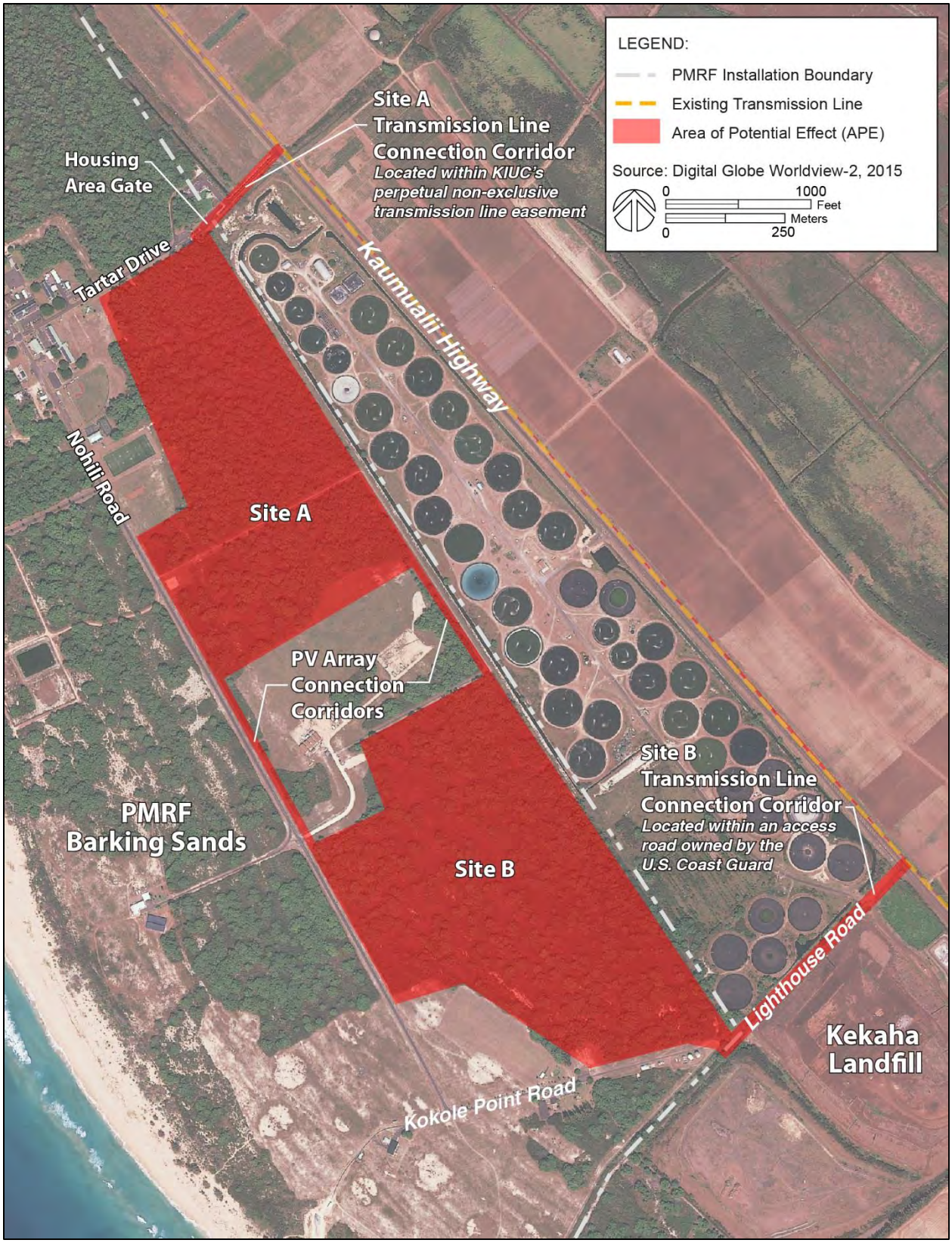


Figure 3-1 PMRF PV and BESS Area of Potential Effect for Cultural Resources

The APEs for the transmission line connection corridors along Tartar Drive and Lighthouse Drive extend beyond the PMRF installation boundary onto land owned by the State of Hawaii and the U.S. Coast Guard respectively. Both transmission line corridor APEs are located in the back beach portion of Kekaha, which has been extensively disturbed by modern activities, including plantation agriculture and modern development. Archaeological studies along the transmission line connection did not find any archaeological sites, features, or deposits (Masterson et al., 1994).

3.4.2.2 Architectural Resources

Previous architectural history surveys at PMRF have evaluated 86 extant individual buildings, structures, and objects (SEARCH, 2012). Of these 86 extant recorded historic architectural properties (buildings, structures, objects), 20 are designated as eligible for listing in the NRHP, but none of these NRHP-eligible properties is located in the vicinity of the proposed project sites. The nearest NRHP eligible property is located approximately 2.4 miles northwest of Site A.

In 2011, a Cultural Landscape Report (CLR) was prepared for PMRF in order to document the installation's historic military landscape (TEC Inc.-JV and NAVFAC Pacific, 2011). As a whole, the PMRF historic landscape was documented as significant or likely significant in several areas and as generally retaining integrity.

Three historic landscape features are located within or adjacent to the APE. The PMRF CLR identifies Nohili Road (constructed by 1940), Tartar Drive (c. 1970), and the Housing Area Gate (c. 1970) on Tartar Drive as both contributing and character defining features within the PMRF historic landscape. Within the landscape, these three circulation features have been identified as contributing to the integrity of the PMRF historic landscape and serve to define its character.

3.4.2.3 Traditional Cultural Properties

Traditional cultural properties (TCP) are eligible for inclusion in the NRHP based on their association with the cultural practices or beliefs of a living community that are (a) rooted in that community's history, and are (b) important in maintaining the continuing cultural identity of the community (National Park Service, 1998). In order to be eligible for listing, TCPs must be tangible properties, though not necessarily human construction, and must retain a relationship to cultural practices while also meeting one of the four NRHP Criteria (36 CFR Part 60).

PMRF-Barking Sands was the subject of an assessment of potential native Hawaiian traditional cultural places (Tomonari and Tomonari-Tuggle, 2004). The study identified 13 Hawaiian cultural place names in the area through ethnographic and archival research. The traditional cultural place names are located outside of the APE for the proposed PV sites. The 13 traditional Hawaiian cultural place names on PMRF identified by Tomonari and Tomonari-Tuggle (2004) have not been evaluated for listing as TCPs in the NRHP; however, they have been determined to be culturally sensitive (SEARCH, 2012).

3.4.3 Environmental Consequences

Analysis of potential impacts to cultural resources considers both direct and indirect impacts. Direct impacts may be the result of physically altering, damaging, or destroying all or part of a resource, altering characteristics of the surrounding environment that contribute to the importance of the resource, introducing visual, atmospheric, or audible elements that are out of character for the period the resource represents (thereby altering the setting), or neglecting the resource to the extent that it deteriorates or is destroyed.

3.4.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to cultural resources. Therefore, no impacts to cultural resources would occur with implementation of the No Action Alternative.

3.4.3.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The project APE for PV Sites A and B is located entirely within an area with low potential for archaeological resources, and previous archaeological inventory surveys and cultural property assessment at PMRF have not located any historic properties on the proposed PV sites or in the immediate vicinity.

The APE for PV Sites A and B is located in the back beach portion of the southern extent of PMRF, which was extensively disturbed by modern activities and therefore has been determined to be an area of low archaeological sensitivity. The APEs for the proposed transmission line connection corridors extend beyond the PMRF installation boundary into state owned lands. Previous archaeological resource investigations of those areas have documented significant 20th century land alterations with no evidence of archaeological sites or cultural deposits. Ground disturbance along these corridors would occur within existing utility line rights of way, and adjacent to existing roadways. All proposed activities along these sections would be to upgrade/replace the current utility lines and power poles, and would therefore take place in areas of previous ground disturbance where it would be unlikely to uncover archaeological resources. Therefore, the Proposed Action would not have an adverse impact on archaeological resources.

The Proposed Action would not impact historic buildings as there are no known historic architectural properties within or adjacent to the APE. Three historic landscape features (Nohili Road, Tartar Drive, and the House Area Gate on Tartar Drive) are located within or adjacent to the proposed project sites. As contributing features within the landscape, these three circulation features have been identified as contributing to the integrity of the PMRF-Barking Sands historic landscape and serve to define its character. However, the Proposed Action would not affect the character defining features of the roads or the gate. Utility lines already exist in the location of the potential transmission line connection corridor along Tartar Drive and in the vicinity of the Housing Area Gate (on Tartar Drive) and therefore new construction or alteration of the existing utility lines would not adversely impact these historic landscape features. Construction of a PV Array Connection Corridor along Nohili Road would not have an adverse impact on the historic roads because the corridor would be located underground thereby preserving the integrity of the open road corridor. Therefore, the Proposed Action would not have an adverse impact on architectural resources, including standing buildings, structures, landscapes, and other built-environment resources of historic or aesthetic significance.

There are no traditional Hawaiian cultural places located within or in the immediate vicinity of the project APE. Therefore, the Proposed Action would not have a significant impact upon traditional cultural properties.

In consideration of the above information, the Navy has determined that the Proposed Action would have “no adverse effect” on historic properties under NHPA Section 106 of the National Historic Preservation Act (NHPA). The Navy has notified the SHPO and Native Hawaiian Organizations (NHOs) of their intent to develop the Proposed Action and has requested concurrence with their determination of effect by letters dated October 28, 2016 and November 10, 2016 respectively (see Section 106 consultation correspondence in Appendix C).

In the unlikely event that Native American Graves Protection and Repatriation Act (NAGPRA) cultural items are discovered, all construction activities will stop and the remains will be stabilized and protected. Treatment will proceed under the authority of NAGPRA.

Therefore, implementation of the Proposed Action would not result in significant impacts to cultural resources.

3.5 Biological Resources

Biological resources include living, native, or naturalized plant and animal species and the habitats within which they occur. Plant associations are referred to generally as vegetation, and animal species are referred to generally as wildlife. Habitat can be defined as the resources and conditions present in an area that support a plant or animal.

Within this EA, biological resources are divided into two major categories: (1) terrestrial vegetation and (2) terrestrial wildlife. Threatened, endangered, and other special status species—if any—are discussed in their respective categories. Table 3-2 lists all special status species that are potentially present.

3.5.1 Regulatory Setting

Special-status species, which for the purposes of this EA are those species listed as threatened or endangered under the Endangered Species Act (ESA), and species afforded federal protection under the Marine Mammal Protection Act (MMPA) or the Migratory Bird Treaty Act (MBTA).

The purpose of the ESA is to conserve the ecosystems upon which threatened and endangered species depend and to conserve and recover listed species. Section 7 of the ESA requires action proponents to consult with the U.S. Fish and Wildlife Service (USFWS) or National Oceanic and Atmospheric Administration (NOAA) Fisheries to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered species, or result in the destruction or adverse modification of designated critical habitat. Critical habitat cannot be designated on any areas owned, controlled, or designated for use by the DoD where an Integrated Natural Resources Management Plan has been developed that, as determined by the Department of Interior or Department of Commerce Secretary, provides a benefit to the species subject to critical habitat designation.

Birds, both migratory and most native-resident bird species, are protected under the MBTA, and their conservation by federal agencies is mandated by EO 13186 (Migratory Bird Conservation). Under the MBTA it is unlawful by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, [or] possess migratory birds or their nests or eggs at any time, unless permitted by regulation. The 2003 National Defense Authorization Act gave the Secretary of the Interior authority to prescribe regulations to exempt the Armed Forces from the incidental taking of migratory birds during authorized military readiness activities. The final rule authorizing the DoD to take migratory birds in such cases include a requirement that the Armed Forces must confer with the USFWS to develop and implement appropriate conservation measures to minimize or mitigate adverse effects of the Proposed Action if the action would have a significant negative effect on the sustainability of a population of a migratory bird species.

The Coastal Zone Management Act establishes a federal-state partnership to provide for the comprehensive management of coastal resources. Coastal states and territories develop management programs based on enforceable policies and mechanisms to balance resource protection and coastal

development needs. Actions implemented on federal lands must ensure consistency with these plans and programs to the maximum extent practicable.

3.5.2 Affected Environment

The following section provides a description of the existing conditions for each of the categories under biological resources at Barking Sands.

The proposed PV sites are covered with *kiawe* trees (*Prosopis pallida*) and scrub vegetation. Some *ʻaʻaliʻi-nama* scrub that consists of native vegetation was observed in an area on Site B. The *ʻaʻaliʻi-nama* scrub is found on the southern half of PMRF-Barking Sands, from about the housing area to the antenna fields. Native plants are the dominant components of this vegetation type. *ʻAʻaliʻi* shrubs (*Dodonaea vicosa*) are abundant, forming an open, patchy cover, five to eight feet tall. *Nama* (*Nama sandwicensis*) is an annual to short-lived perennial herb, which is more abundant during the wetter parts of the year. Other native plants which are common to occasional in this vegetation type include *naupaka* (*Scaevola sericea*), *ilima* (*Sida fallax*), *uhaloa* (*Waltheria indica*), *alena* (*Boerhavia repens*), *pohinahina* (*Vitex rotundifolia*), and *akiʻaki* (*Sporobolus virginicus*). The *pololei* fern (*Ophioglossum polyphyllum*) is frequently encountered, growing in low lying areas on the sand substrate and forming fairly large colonies. *Kiawe* is found scattered throughout the *ʻaʻaliʻi-nama* scrub as individual trees or small stands of trees. Clumps of buffel grass (*Cenchrus ciliaris*) and Guinea grass (*Megathyrsus maximus*) as well as lantana shrubs (*Lantana camara*) are found under and around the *kiawe*. *Koa haole* (*Leucaena leucocephala*) shrubs tend to occur along the edges of the *ʻaʻaliʻi- nama* scrub where it has been disturbed.

The land area encompassed by Site A (approximately 87 acres) and Site B (approximately 94 acres) may support the federally-endangered Hawaiian goose or *nēnē* (*Brandta sandvicensis*). In addition, the federally-endangered Hawaiian hoary bat or *ʻōpeʻapeʻa* (*Lasiurus cinereus semotus*) may be present in the area and the federally-threatened Newell's shearwater or *ʻAʻo* (*puffinus auricularis*), the federally-endangered band-rumped storm-petrel or *ʻakeʻake* (*Oceanodroma castro*), and the federally-endangered Hawaiian petrel or *ʻUaʻu* (*Pterodroma sandwichensis*) may make overflights of the area during their breeding seasons. Table 3-2 provides a list of the federally threatened or endangered species known to occur at the proposed PV sites.

Table 3-2 Threatened and Endangered Species Known to Occur in the Project Area

Common Name	*Scientific Name*	*Federal Listing Status*	*Are the PV sites a Critical Habitat?*
Hawaiian goose (*Nēnē*)	*Brandta sandvicensis*	Endangered	No
Hawaiian hoary bat (*ʻōpeʻapeʻa*)	*Lasiurus cinereus semotus*	Endangered	No
Newell's shearwater (*ʻAʻo)*	*Puffinus auricularis*	Threatened	No
Band-rumped storm-petrel (*ʻakeʻake*)	*Oceanodroma castro*	Endangered	No
Hawaiian petrel (*ʻUaʻu)*	*Pterodroma sandwichensis*	Endangered	No

3.5.2.1 Terrestrial Vegetation

Vegetation includes terrestrial plant communities and constituent plant species. Six vegetation types are recognized on undeveloped portions of PMRF-Barking Sands but only three vegetation types are found at the proposed PV sites, including:

- Ruderal weedy vegetation is found along the roadways, fencelines, and parcels where the natural vegetation has been disturbed. The most abundant types of plants are non-native, low grasses forming either clumps or dense mats, depending on the species. Golden crown-beard (*Verbesina sp.*), an introduced member of the daisy family, and buffel grass (*Cenchrus ciliaris*) typically invade disturbed sites (Navy, 2008a).
- *Kiawe (Prosopis pallida)-koa haole (Leucaena leucocephala)* scrub occupies the vast majority of the site and includes mostly non-native species. At the proposed PV sites, this scrub vegetation grows in tall, dense forests with mature trees, some reaching approximately 40 ft. in height.
- *ʻAʻaliʻi (Dodonaea viscosa)-nama (Nama sandwicensis)* scrub covers a small area near the southwest border of PV site B. This vegetation type is mostly made up of native species of trees, shrubs, and low herbaceous plants.

There are no known threatened or endangered plant species presently existing in PMRF-Barking Sands. Two Federally endangered plants, the *ʻōhai* (*Sesbania tomentosa*) and *lau`ehu* (*Panicum niihauense*), have been observed north of, but not within PMRF-Barking Sands. *ʻŌhai* has been observed in the sand dunes in Polihale State Park and could potentially occur within PMRF-Barking Sands. A critical habitat was established for the *lau`ehu* on land in the northern section of PMRF-Barking Sands, adjacent to Polihale State Park and in dune areas along the southern portion of the range, specifically the Kauai Test Facility coastal area and the area adjacent to Kokole Point. This critical habitat is located along the coastline approximately 1,500 ft. to the west of the proposed PV sites at its nearest point.

Nama sandwicensis was added as a species of concern in 1999. Species of concern do not receive legal protection under Federal or state endangered species laws. Typically, plants that are designated as species of concern are species for which more biological or taxonomic information is needed. At present, *Nama sandwicensis* is considered to be a low priority species and has a wide distribution range on many Hawaiian Islands.

3.5.2.2 Terrestrial Wildlife

Wildlife includes all animal species (i.e. insects and other invertebrates, fish, amphibians, reptiles, birds, and mammals) focusing on the species and habitat features of greatest importance or interest. Table 3-2 provides a list of federally threatened or endangered species which may occur at the proposed PV sites.

Amphibians and Reptiles

There are non-native land reptiles in the Hawaiian Islands. During a recent survey, the land reptiles observed on PMRF-Barking Sands were the house gecko (*Hemidactylus frenatus*), mourning gecko (*Lepidodactylus lugubris*), and snake-eyed skink (*Cryptoblepharus poecilopleurus*) (Navy, 2008a). As result of human interaction, the two gecko species have been able to expand their distribution and are widely found in many of the world tropical and subtropical regions. The snake-eye skink is widely distributed among the Pacific islands, and is found mostly on rocky costal habitats such as rock walls, areas with lava rock overlooking adjacent beaches (Lever, 2003).

Mammals

Feral cats (*Felis catus*) and roof rats (*Rattus rattus*) are the most common species of terrestrial mammals recorded on PMRF-Barking Sands (Navy, 2008a). Dogs (*Canis familiaris*) also run loose at the north end of the property in the area of the large dunes. No feral pigs (*Sus scrofa*) or blacktailed deer (*Odocoileus hemionus*) were found during the most recent survey. However, pigs probably occur in this area, with deer being a less frequent visitor to the lowlands of PMRF.

Hawaii's federally endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) is the only native terrestrial mammal. This species has been recorded on Kauai, Oahu, Maui, and Hawaii. During the day, the species roosts in trees, up to 4,000 feet elevation, and forages on insects concentrated by offshore winds. The Hawaiian hoary bat (*Lasiurus cinereus semotus*) is listed as a Federal and State endangered species. The subspecies is the only land mammal endemic to Hawaii. Hawaiian hoary bats generally occur in or near forest habitat. Their diet consists of flying insects. Hawaiian hoary bats have been observed to forage over open fields, over open ocean near the mouths of river or stream outlets, and over streams and ponds. The current population size of Hawaiian hoary bats is unknown, but the greatest threats to populations are thought to be habitat loss, use of pesticides, and predation. It has been recorded at PMRF; a group of four was observed foraging around the sewage treatment ponds, and another separate group of five bats was seen just offshore of northern PMRF (PMRF, 2007). It has also been observed at the Polihale State Park north of the base (CNRH, 2010; PMRF, 2001). The bat is known to frequent the general area of the Makaha Ridge Tracking Station at PMRF-Barking Sands which is located approximately 9.4 miles to the northeast of the proposed PV sites. The bat may forage or roost on the property or surrounding forested areas (CNRH, 2010).

Due to a lack of clear knowledge of the current status of bats at PMRF, the Navy contracted U.S. Geological Survey (USGS) Pacific Island Ecosystem Research Center biologists to survey for bats at PMRF from June 2010 through June 2011. During the week of 9 September to 6 December 2010, USGS biologists deployed four Anabat detectors on the southern half of PMRF Main Base: one along the west side of the Sunrise Shrimp Farm adjacent to the proposed PV sites, one at the PMRF sewage treatment pond, one at the Hawaii Air National Guard site, and one along the Kinikini Ditch just southeast of the PMRF runway. During the bi-monthly, yearlong surveys, bats were detected at all of the sampling location for the southern half of PMRF-Barking Sands. Bat call activity counts were highest for the south region in September - October 2010 period. Wildlife sound recorders were also deployed from Nohili Ditch (approximately 150 yards from the ocean) to the Aegis Ashore Interceptor Launch Area (detectors were also placed at two locations at Kamokala Magazines, a PMRF site east of the Main Base) making up the western section of the base. Bat activity showed a stable moderate to low number of calls over the entire year, with slight peaks in January through August.

Birds

Multiple native, non-native, and migratory birds have been observed on PMRF-Barking Sands (ibid). Some of these birds are also federally-listed threatened or endangered species. Native birds recorded include endemic and indigenous water birds as well as seabirds. Introduced birds (e.g., zebra dove. cattle egret, and common myna) are considered the most abundant at PMRF-Barking Sands. This is typical of lowlands in the Hawaiian Islands, where most of the natural habitats have been altered by development and agriculture. Migratory bird species that may be found within the PMRF-Barking Sands include, but are not limited to, the Laysan albatross (*Phoebastria immutabilis*), black-crowned night heron (*Nycticorax nycticorax*), northern shoveler (*Anas clypeata*), Pacific golden plover (Pluvialis fulva),

wandering tattler (*Heteroscelus incanus*), ruddy turnstone (*Arenaria interpres*), brown booby (*Sula leucogaster*), wedge-tailed shearwater (*Puffinus pacificus*), Newell's Shearwater (*Puffinus auricularis*), Hawaiian Petrel (*Pterodroma sandwichensis*), band-rumped storm-petrel (*Oceanodroma castro*), sanderling (*Calidris alba*), cardinal (*Cardinalis cardinalis*), northern mockingbird (*Mimus polyglottos*), and the house finch (*Carpodacus mexicanus*). A nesting colony of wedge-tailed shearwaters (*Puffinus pacificus*) is present near the beach cottages near the center of the PMRF facility and in the Nohili Dune area at the northern end of the facility (Navy, 2008b). The location of the nearest shearwater colony is approximately 1.3 miles to the north west of the proposed PV site A near the beach cottages.

The Newell's shearwater is endemic to the main Hawaiian Islands (Ainley et al. 1997). The subspecies was federally listed as threatened in 1975. As with the Hawaiian petrel, the largest breeding colonies of Newell's shearwaters occur on Kauai, with nesting also occurring on Molokai and Hawaii (Ainley et al. 1997). Newell's shearwaters nest in burrows or deep rock crevices at elevations from 525 to 4000 ft. Due to predation pressure by introduced mammals, nesting is now restricted to slopes that exceed a 65° angle (Ainley et al. 1997). The breeding season for Newell's shearwaters is estimated to be April through November. On Kauai, eggs are laid during the first two weeks of June, and fledglings leave the burrows in October (Telfer et al. 1987). In 1995, the total population size of Newell's shearwaters was estimated to be 84,000 (Spear et al. 1995). As with Hawaiian petrels, the greatest threats to Newell's shearwater populations are non-native predators, including barn owls (*Tyto alba*), cats, and rats (U.S. Fish and Wildlife Service 1983, Ainley et al. 1997, Ainley et al. 2001).

The Hawaiian petrel was federally listed as endangered in 1967 (Simons and Hodges 1998). Populations of the Hawaiian petrel nest on the islands of Hawaii, Maui, Lanai, and Kauai, and they may also nest on Molokai, Lehua and the seastacks off of Kahoolawe (Simons and Hodges 1998, Hawaii DNLR 2005b). The largest Hawaiian petrel breeding colonies occur on Kauai (Cooper and Day 1998, Hawaii Department of Land and Natural Resources 2005), where the birds are thought to excavate burrows under dense vegetation along headwalls of interior valleys (Simons and Hodges 1998). On Kauai, eggs are laid from May through June, and most young birds fledge by December (Hawaii Department of Land and Natural Resources 2005). In 1995, the total population size of Hawaiian petrels was estimated to be 19,000 (Spear et al. 1995). The greatest threat to the Hawaiian petrel is predation by non-native avian and mammalian predators, including barn owls (*Tyto alba*), cats, and rats (U.S. Fish and Wildlife Service 1983).

The band-rumped storm-petrel occurs throughout the Pacific and Atlantic oceans, breeding in Japan, the Galapagos Islands, Hawaii, and eastern Atlantic islands off of the coasts of Europe and Africa. While not considered to be threatened across its global range, the band-rumped storm-petrel was listed as endangered under the ESA on October 31, 2016 (Federal Register 2016). In Hawaii, band-rumped storm-petrels are known to nest on Kauai and are thought to nest on the islands of Hawaii and Maui. The known breeding colony on Kauai is restricted to steep cliffs dominated by native plant species. Although population size has not been well-quantified for this species in Hawaii, there are thought to be more than 100 breeding pairs on Kauai (Slotterback 2002). The species is thought to begin nesting in April in Hawaii, with juveniles fledging from the nests in October (Slotterback 2002). Ingested contaminants and plastics, degradation of nesting and foraging habitats, and collisions with structures are considered to be the greatest threats to band-rumped storm-petrel populations (Slotterback 2002).

The federally and state listed endangered *nēnē* or Hawaiian goose (*Branta sandvicensis*) is endemic to Hawaii and Maui, and has been introduced at Makaha Ridge of the PMRF complex. *Nēnē* are known to occur at PMRF-Barking Sands. It is suspected, that they are attracted to the Main PMRF-Barking Sands

during extended dry periods. They may fly from higher elevations (e.g., Makaha and Kokee areas) to feed on the well-watered and mowed grassy areas of the base. Because *nēnē* are large-bodied birds they are a Bird Airstrike Hazard (BASH), so the Navy hazes Hawaiian geese from the flight area to reduce this risk. The Navy also deters goose nesting on PMRF-Barking Sands to prevent young from returning to its place of birth due to site fidelity. In spite of this hazing, *nēnē* are known to use areas adjacent to the project site for loafing and foraging, and nesting *nēnē* have been observed in the northern portion of Site B. The proposed PV sites could potentially provide habitat for *nēnē,* but the vegetation does not support favorable habitat.

3.5.3 Environmental Consequences

This analysis focuses on wildlife or vegetation types that are important to the function of the ecosystem or are protected under federal or state law or statute.

3.5.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to biological resources. Therefore, no significant impacts to biological resources would occur with implementation of the No Action Alternative.

3.5.3.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The biological resources study area for the Proposed Action includes the 181 acres of land occupied by Site A (approximately 87 acres) and Site B (approximately 94 acres); the portions of Tartar Drive, Nohili Road, and Kokole Point Road that abut the proposed PV sites; the proposed subsurface power connection corridors between Sites A and B; and, the overhead transmission line connection corridors along Tartar Drive and Lighthouse Road.

Vegetation

The vast majority of proposed PV sites are covered with *kiawe* trees and an understory of scrub vegetation. A small area along the western edge of the proposed PV sites is vegetated by *ʻaʻaliʻi-nama* scrub, however, there are no threatened, endangered, or candidate species of terrestrial plant life on the proposed PV sites. No vegetation or soil disturbance shall be conducted beyond the footprint of the project's defined project area. The clearing of vegetation from the PV sites shall be managed to minimize the threat of wildfire spreading onto adjacent vegetation.

Terrestrial Wildlife

The construction of the Proposed Action would include the clearing of vegetation, which would disturb wildlife residing on the project site. However, the proposed PV sites do not provide unique or sensitive habitat and wildlife that may be disturbed during construction could easily relocate to similar habitat in adjacent areas. During the operational period, skirting would be placed around the PV arrays as necessary to prevent the shaded area underneath the panels from becoming a habitat for feral animals. Recent reports suggest that solar arrays may pose a danger to some bird species. Many of these reports refer to concentrated solar technology which uses mirrors to concentrate solar energy, this technology is not being considered for the Proposed Action. It is also suggested that water birds may mistake solar PV arrays for bodies of water and attempt to land or fly into the panels (Upton, 2014). However, the proposed PV array is not expected to pose a threat to water birds in the project vicinity. The PV array would consist of panels that are placed at an angle instead of a horizontal position and rows of PV panels would be spaced apart for vehicular maintenance, making it less likely to be mistaken for a body

of water. Therefore, it is unlikely that the possibility of birds attempting to land on or fly into the panels would be a problem. To minimize the potential for bird strikes, the design of the PV systems would not include guy wires that could create a strike hazard.

Threatened and Endangered Species

Temporary impacts on threatened, endangered or candidate terrestrial species could occur from noise and habitat disturbances associated with construction activities. However, threatened, endangered, and candidate terrestrial species at PMRF-Barking Sands are already habituated to high levels of noise associated with airfield and range operations, missile launches, and past construction projects. Increases in noise levels from construction activities to the ambient noise environment would be negligible and temporary. Loss of vegetation would occur under the Proposed Action. However, the project site does not include critical habitat for threatened or endangered species. Additionally, installation personnel would continue to manage habitats according to the Installation Natural Resources Management Plan (INRMP), which is designed to protect and benefit threatened and endangered species.

The proposed construction project would clear the 181 acres of kiawe trees and other non-native vegetation, which is a potential roosting and pupping site for hoary bats. Since hoary bats utilize a wide range of vegetation and habitat types for roosting, it is assumed they could easily find other roosting sites in the adjacent area or other areas throughout the base if displaced by vegetation clearing. Young bats could also use this area during the pupping and fledging season. Therefore, the PV contractor shall be responsible for ensuring that no trees taller than 15 feet be trimmed or removed during the Hawaiian hoary bat's pupping season which occurs between June 1 and September 30 because non-volant juvenile bats (bats that cannot fly) may be roosting in the trees. If any bat pups are discovered in the construction zone, outside the normal nesting season, vegetation clearing must stop and move 100 yards away. Construction cannot resume until the bat pups have fledged and departed the area. In addition, fences erected at the PV sites would not have top-strand barbed wire to prevent the Hawaiian hoary bats from getting entangled on the barbed wire. The implementation of the preceding guidelines, which are promulgated by the USFWS (1998), are expected to minimize potential impacts to the Hawaiian hoary bat (NAVFAC, 2015).

The proposed project would clear the 181 acres of kiawe trees and other non-native vegetation, which is a potential nesting habitat for the *nēnē* from August to April. If construction occurs during the nesting season, hazing will be conducted to prevent geese from nesting or loafing in the construction site. Hazing will be conducted before and during the nesting season to deter geese from settling on the site. The developer would be responsible for ensuring that a qualified biologist approved by the Navy conducts any hazing activities. During the construction period, if a *nēnē* is observed within the PV site, or if a *nēnē* flies into the site while activities are occurring, all activities would halt within 100 feet of the bird(s). Work would resume until the bird(s) have left the area on their own accord. In the unlikely event that a nest is found during construction despite hazing, a 100-foot buffer would be established around active nests and broods until the goslings have fledged. Potential disturbing activities (i.e. construction or noisy equipment use) would not be conducted within this buffer. The implementation of the preceding guidelines, which are promulgated by the USFWS are expected to avoid all direct impacts to the *nēnē.*

Federally-protected migratory birds that may pass through or use the PV site for foraging or loafing could be displaced by the installation of the PV arrays. This would not have a significant impact on these species since they would relocate to adjacent areas with suitable habitat. Should nests of MBTA species

be found in areas where PV arrays are planned, the installation of equipment at that location would be delayed until after the nest fledges or naturally fails on its own accord. To ensure that all parties are aware of this procedure, a coordination meeting with the PV contractor, construction workers, and PMRF environmental staff shall be held prior to the start of construction for instructional purposes.

Construction of the utility poles that connect the PV system to the KIUC transmission lines could cause a collision hazard for nocturnal seabirds. The utility poles will have two levels of transmission lines to support the 57 kV line above the 12.4kV line. Nocturnal seabirds have the potential to collide into tall structures in their flight path from the ocean to roosting sites at higher elevations. Although the lines will be placed on existing poles, the addition of more lines increase the chances for seabirds to collide with the wires. Nocturnal seabird collision with communication towers or utility lines has not been observed at PMRF (Navy, 2013). In 2008, a survey for dead birds was conducted under all communication towers at Barking Sands. No dead seabirds were found during the period from mid-October to mid-December 2008 (Navy, 2013).

Newell's shearwaters, Hawaiian petrels, and band-rumped storm-petrels only nest at high elevations on Kauai. Because Barking Sands is located along the coastline of Kauai, there is no potential for these species to nest at the proposed PV site. Individuals of these species do commute between inland breeding colonies and at-sea foraging areas, making all of the PMRF sites potential areas for nocturnal seabird over-flights. The period of October through December is particularly critical for these species in terms of over-flights, as fledglings leave the inland nests for their first trips to sea (Ainley et al. 1997, Simons and Hodges 1998). Because nocturnal seabirds (*Puffinus auricularis, Pterodroma sandwichensis, Oceanodroma castro*) have the potential to collide with tall structures such as the utility line poles, surveys for downed seabirds will occur under the utility lines. The developer will be responsible for providing a qualified biologist to search the area under the utility lines for any downed birds that may collide with the structures. The searches will be conducted for one year after the utility lines have been constructed to assess the rates of nocturnal seabird strikes. Results of the monitoring efforts will be reported during the yearly reporting meeting with the FWS. The biologist will be approved by the Navy and will follow carcass search protocols provided in the 2014 Base-wide Biological Opinion (FWS 2014).

To minimize potential project impacts to the nocturnal seabirds during their breeding season, all outdoor lights on buildings or structures where work related to the Proposed Action is conducted would be retrofitted to be fully shielded so the bulb can only be seen from below bulb height and only used when necessary. Nighttime construction would be avoided during the seabird fledging period, September 15 through December 15. If nighttime construction occurs during other times of year, all lighting would be shielded and directed toward the ground to avoid attracting adult seabirds as they travel from the ocean to their breeding areas (USFWS, 2015). During the operational period, to minimize the potential of seabird fallout or disorientation and avoid potential impacts to nocturnal birds, permanent outdoor lighting shall be on motion sensors, fully shielded and downward facing, utilizing light-emitting diodes, and in compliance with PMRF Dark Skies Program Requirements. The impact of the preceding guidelines, which are promulgated by the USFWS, are expected to minimize potential impacts to the MBTA species.

Pursuant to the Sikes Act Improvement Amendment and ESA Section 7(a) (2), the Navy has requested USFWS informal consultation and concurrence with their finding that the Proposed Action may affect, but is not likely to adversely affect (NLAA) the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*); nocturnal seabirds (*Puffinus auricularis* (Newell's Shearwater), *Pterodroma sandwichensis* (Hawaiian petrel), and *Oceanodroma castro* (Band-rumped Storm-petrel)); and the *nēnē* (*Branta sandvicensis*) by letter dated December 19, 2016 (see ESA Section 7 Consultation Correspondence in Appendix B).

During the decommissioning process, BMPs such as those utilized during the construction and operational phases would be implemented as necessary to avoid or minimize potential impacts to biological resources.

Therefore, implementation of the Proposed Action would not result in significant impacts to biological resources.

3.6 Land Use

This discussion of land use includes current and planned uses and the regulations, policies, or zoning that may control the proposed land use. The term land use refers to real property classifications that indicate either natural conditions or the types of human activity occurring on a parcel. Two main objectives of land use planning are to ensure orderly growth and compatible uses among adjacent property parcels or areas. However, there is no nationally recognized convention or uniform terminology for describing land use categories. As a result, the meanings of various land use descriptions, labels, and definitions vary among jurisdictions. Natural conditions of property can be described or categorized as unimproved, undeveloped, conservation or preservation area, and natural or scenic area. There is a wide variety of land use categories resulting from human activity. Descriptive terms often used include residential, commercial, industrial, agricultural, institutional, and recreational.

Visual resources are discussed in Section 3.7, Visual Resources.

3.6.1 Regulatory Setting

In many cases, land use descriptions are codified in installation master planning and local zoning laws. Office of the Chief of Naval Operations Instruction (OPNAVINST) 11010.40 establishes an encroachment management program to ensure operational sustainment that has direct bearing on land use planning on installations. Additionally, the joint instruction OPNAVINST 11010.36C and Marine Corps Order 11010.16 provides guidance administering the Air Installation Compatible Use Zone (AICUZ) program, which recommends land uses that are compatible with noise levels, accident potential, and obstruction clearance criteria for military airfield operations. OPNAVINST 3550.1A and Marine Corps Order 3550.11 provide guidance for a similar program, Range AICUZ. This program includes range safety and noise analyses, and provides land use recommendations which would be compatible with Range Compatibility Zones and noise levels associated with military range operations.

The Coastal Zone Management Act provides states and territories, with federally approved coastal management programs, the authority to review federal activities that have a reasonably foreseeable effect on land use, water use, or natural resource of the coastal zone. Federal agencies provide a consistency determination for proposed federal agency activities. Federal activities are reviewed for consistency with enforceable policies of state or territorial management programs and states or territories either concur with or object to the activity. If a state or territory objects to a federal agency

activity, the federal agency may not proceed unless it determines it is prohibited from full consistency due to requirements of federal law.

3.6.2 Affected Environment

The following discussions provide a description of the existing conditions for land use at PMRF-Barking Sands.

3.6.2.1 Land Use Compatibility

PMRF-Barking Sands is located on Mana Plain along the west shore of Kauai. The site is a long, narrow strip bordered by agricultural and undeveloped coastal land to the east, open ocean to the west, a low priority installation restoration site to the south, and Polihale State Park to the north. The site consists of approximately 2,060 acres. At its northern and southern boundaries, Barking Sands is just over 0.6 miles wide, and narrows to 0.3 miles wide in its central and narrowest areas. The Barking Sands facility provides radar tracking and surveillance, global positioning system data processing, a communication network, and command and control for the Range Operations Center. The airfield supports cargo planes, tactical aircraft, and helicopters. The main base provides a target support and a live ordnance area (Red Label), ordnance and launching area, and a torpedo shop for torpedo operations and recovery.

Land use on a large portion of Barking Sands is constrained by restrictions on activities that can be safely conducted near facilities that handle or store ordnance, ground hazard zones, airfield operations, and safety zones. Ground hazard areas are temporarily established during missile and rocket launches, as well as during radar operations, to exclude the public and non-mission essential personnel from potentially unsafe areas.

PMRF manages its land use in accordance with the recently completed 2016 Installation Development Plan (IDP). The IDP is the overall long-term development plan for PMRF-Barking Sands and outlying areas and addresses future land use, circulation and parking, and facility and utility infrastructure development.

The Navy has an existing lease with the State of Hawaii (general lease no. S-3852, amended 10 September 2007) for 12.422 acres directly adjacent to the installation's Main Gate and along Tartar Drive to Kaumualii Highway. KIUC has an a perpetual non-exclusive transmission line easement (recorded in Liber 14651, page 597) on which existing 12.47 kilovolt (kV) service feeder lines which service the installation are located. This easement could allow for the potential installation and/or upgrade of transmission lines and additional utility poles along Tartar Drive to facilitate the connection of the Site A PV and BESS facilities to the existing 57 kV KIUC transmission line running along Kaumualii Highway. The proposed point of connection to the KIUC transmission line would be located at the intersection of Tartar Drive and Kaumualii Highway.

A thirty-foot wide U.S. Coast Guard access road (Lighthouse Road / Kokole Point Road) exists on the southern edge of the installation boundary on which existing 12.47 kV service feeder lines which service the installation are located. Use of this access road could, subject to a separate use agreement, allow for the installation and/or upgrade of transmission lines and additional utility poles along Lighthouse Road to facilitate the connection of the Site B PV and BESS facilities to the existing 57 kV KIUC transmission line running along Kaumualii Highway. Lighthouse Road runs from the southeast corner of the installation to Kaumualii Hwy between the State of Hawaii-owned Shrimp Farm and the County of Kauai-owned Kekaha Landfill. The proposed point of connection to the KIUC transmission line would be located at the intersection of Lighthouse Road and Kaumualii Highway.

With the exception of the transmission line corridors, the Proposed Action would be located entirely within DoD property, but the adjacent non-DoD lands are regulated under the County of Kauai General Plan. The General Plan identifies the importance of PMRF in supporting the establishment of high-technology businesses on Kauai, and acknowledges that "continuing agriculture and aquaculture operations on adjacent State lands provides a buffer and uses surface water that would otherwise inundate the base (County of Kauai, 2000)."

3.6.3 Environmental Consequences

The location and extent of a Proposed Action needs to be evaluated for its potential effects on a project site and adjacent land uses. The foremost factor affecting a Proposed Action in terms of land use is its compliance with any applicable land use or zoning regulations. Other relevant factors include matters such as existing land use at the project site, the types of land uses on adjacent properties and their proximity to a Proposed Action, the duration of a proposed activity, and its permanence.

3.6.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to land use. Therefore, no significant impacts would occur with implementation of the No Action Alternative.

3.6.3.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The site proposed for the Proposed Action and adjacent lands define the study area for land use analyses.

As indicated in the PMRF IDP, the Existing Land Use Map identifies the proposed PV sites as Open Space. The IDP Development Areas Map designates the proposed PV sites as Developable, and the Future Land Use Map classifies the proposed PV sites as Industrial use. The Future Development Plan for PMRF's Personnel Support Area (South) identifies Site A as the location for a proposed PV Farm. Site B was selected after the completion of the IDP and therefore, was not included in the IDP. Site B was designated as Industrial Use in the Future Land Use Map. The use of both proposed PV sites is compatible with future land uses planned for the site as set forth in the IDP (NAVFAC, 2016).

Adjacent non-PMRF land uses such as the private Sunrise Shrimp Farm (east of Site A and Site B), and the County Kekaha Landfill (east of Site B) would not be affected by the Proposed Action nor would off-base land uses in the area such as the Kekaha Rifle Range (south), Kauai Raceway Park (south-southeast), and Syngenta's seed corn complex (southeast).The County of Kauai West Side Planning District Land Use Map does not cover PMRF, but it does identify the adjacent landfill, shrimp farm, and seed corn complex as agricultural land uses, and the Kauai Raceway Park as open space. The proposed PV systems would be compatible with these adjacent land uses.

The proposed transmission line corridors would be compatible with KIUC's perpetual non-exclusive transmission line easement along Tartar Drive, and the U.S. Coast Guard' access Road (Lighthouse Road) subject to a separate use agreement. Both of which are currently occupied by 12.47 kV electrical distribution lines.

The Proposed Action would not impact existing adjacent PMRF land uses such as the NGIS or the future Morale, Welfare, and Recreation Complex which both lie to the west of Site A. Nor would it affect the existing Terminal High Altitude Aerial Defense (THAAD) facility between Site A and Site B, the golf driving range to the west of Site B, or a smaller NGIS facility across the street (Kokole Point Road) from the driving range.

The Navy/Marine Corps and the State of Hawaii's Office of Planning (OP) have come to an agreement that certain activities listed on the "Navy/Marine Corps *De Minimis* Activities Under CZMA" (*De Minimis* Activity List) are not subject to further review by the Hawaii Coastal Zone Management Program when such activities are conducted in accordance with specified "Project Mitigation/General Conditions." The Proposed Action to lease land for the construction and operation of a PV system at PMRF is consistent with Items 1 and 2 on the *De Minimis* Activity List regarding New Construction and Utility Line Activities.

Notification of the use of the list and the preparation of the EA to the State of Hawaii CZM Program was submitted on October 4, 2016. The State CZM program acknowledged receipt of the Navy's notification by email dated October 4, 2016 (see CZMA consultation correspondence in Appendix A).

Therefore, implementation of the Proposed Action would not result in significant impacts to land use.

3.7 Visual Resources

This discussion of visual resources includes the natural and built features of the landscape visible from public views that contribute to an area's visual quality. Visual perception is an important component of environmental quality that can be impacted through changes created by various projects. Visual impacts occur as a result of the relationship between people and the physical environment.

3.7.1 Regulatory Setting

The Hawaii Coastal Zone Management Program sets forth objectives and policies for scenic and open space resources that are intended to protect, preserve, and improve the quality of coastal scenic and open space resources as well as ensure that new development is compatible with its visual environment and that development minimizes alterations to natural landforms and existing public views to and along the shoreline. In developing public facilities and administering land use regulations, the Kauai County General Plan states that the County shall seek to preserve scenic resources and public views, which are defined as those views from a public place, such as a park, highway, or along the shoreline. The Kauai County General Plan Heritage Resources Maps identify Kaumualii Highway in the vicinity of the Proposed Action as a scenic roadway corridor. The General Plan explains, "The purpose of designating Scenic Roadway Corridors is to conserve open space, scenic features, and views within and along Kauai's most heavily-traveled routes (County of Kauai, 2000)."

3.7.2 Affected Environment

Aesthetics refers to the study of the value of sensory-based emotions, sometimes called judgments of sentiment and taste. Aesthetic interest is a subjective issue and depends on the perception of the interested source (e.g., a person, organization, or business). In order for a Proposed Action to have a potential aesthetic impact, an interested source must be present.

The proposed PV sites are located within the controlled-access PMRF-Barking Sands installation, and public views into the proposed PV site are limited to those attained from Kaumualii Highway. The Sunrise Shrimp Farm provides a buffer between the highway and the proposed PV sites. Kaumualii Highway's intersection with Tartar Drive provides the nearest public view into the proposed PV sites at a

distance of approximately 700 feet (Figure 3-2). Moving to the south along Kaumualii Highway, the distance between the highway and the proposed PV sites gradually increases, reaching a distance of 1,600 feet at the highway's intersection with Lighthouse Road. Along this stretch, views of the existing kiawe-koa haole scrub vegetation within the proposed PV sites are partially obstructed by intervening fences, berms, vegetation, netting, and other supporting facilities associated with the shrimp farm operations (Figure 3-3 and Figure 3-4).

The proposed transmission line connection corridors along Tartar Drive and Lighthouse Road extend from the proposed PV sites to Kaumualii Highway, a distance of approximately 700 ft. and 1,600 ft. respectively. These corridors are directly visible to the general public from the highway. Existing views of the Tartar Drive corridor are characterized by a landscaped row of fan palms leading to the PMRF-Barking Sands main gate, and existing overhead utility lines and poles (Figure 3-2). Views of the Lighthouse Road corridor are characterized by the entrance to the County of Kauai's Kekaha Landfill, and existing overhead utility lines and poles (Figure 3-5).

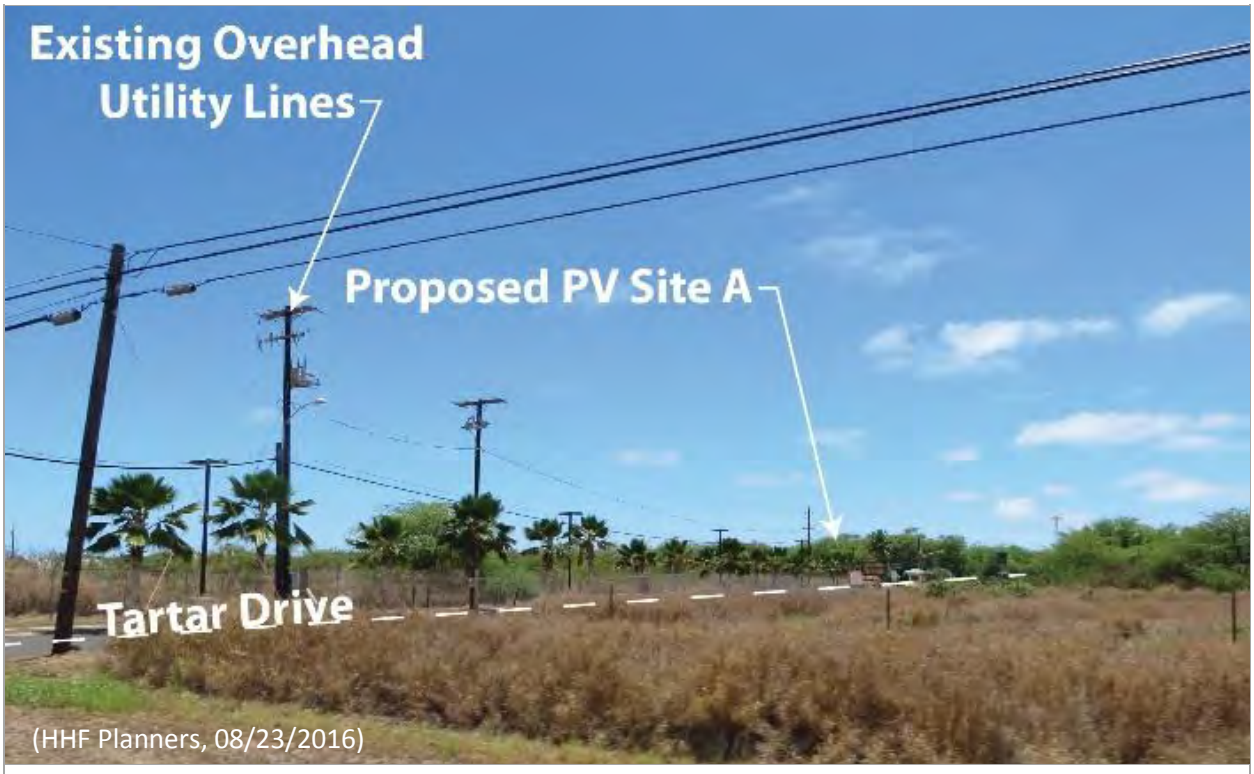


Figure 3-2 View looking southwest from Kaumualii Highway towards the proposed PV Site A and the proposed transmission line connection corridor along Tartar Drive

Figure 3-3 **Typical view looking southwest from Kaumualii Highway toward the proposed PV Site A**

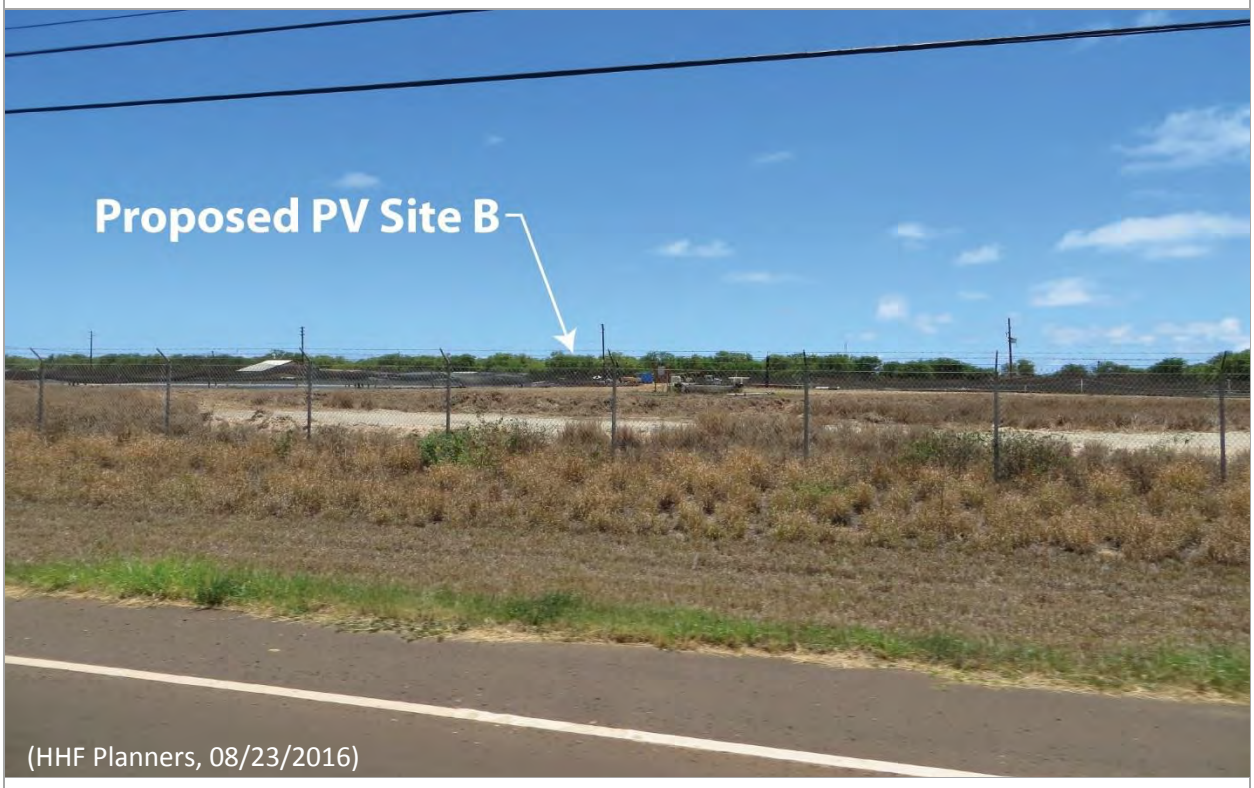


Figure 3-4 **Typical view looking southwest from Kaumualii Highway toward the proposed PV Site B**

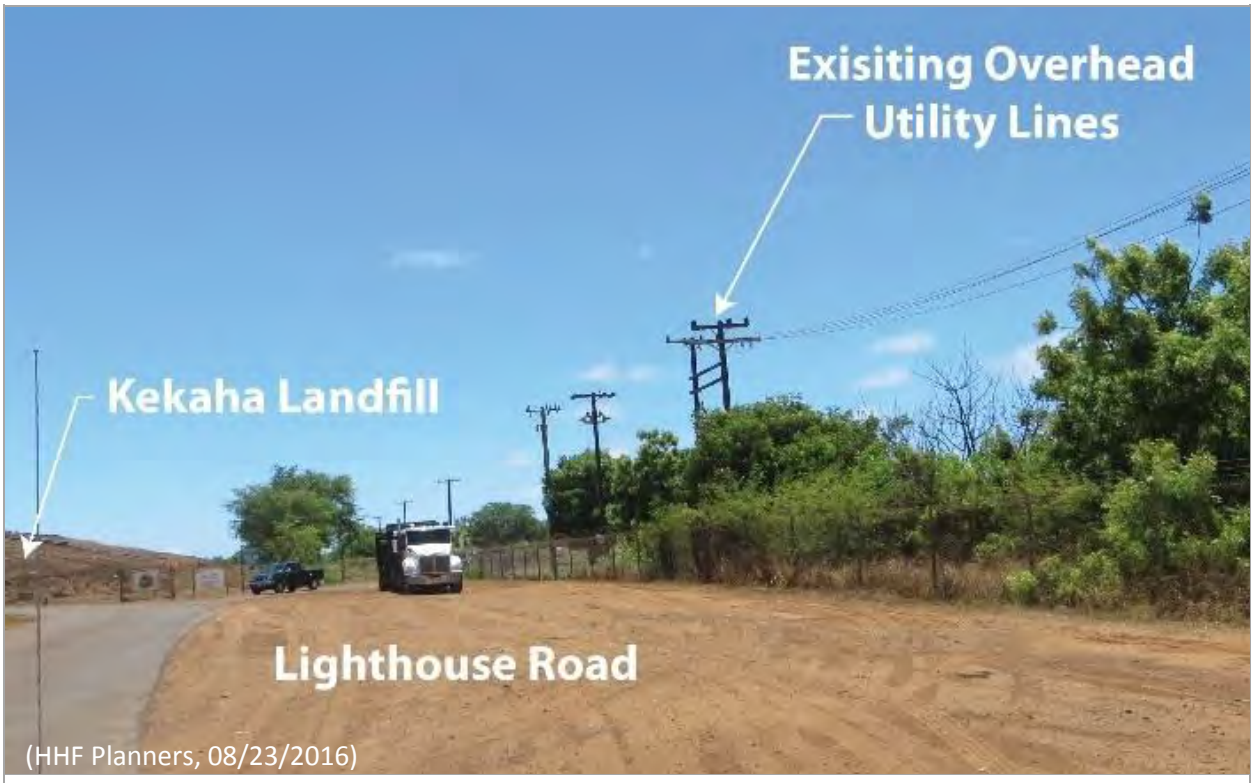


Figure 3-5 View looking southwest from Kaumualii Highway toward the proposed transmission line connection corridor along Lighthouse Road

Figure 3-6 Example of a typical ground-mounted PV array

3.7.3 Environmental Consequences

The evaluation of visual resources in the context of environmental analysis typically addresses the contrast between visible landscape elements. Collectively, these elements comprise the aesthetic environment, or landscape character. The landscape character is compared to the Proposed Action's visual qualities to determine the compatibility or contrast resulting from the buildout and demolition activities associated with the Proposed Action.

3.7.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to visual resources. Therefore, no significant impacts would occur with implementation of the No Action Alternative.

3.7.3.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The site proposed for the Proposed Action and adjacent lands define the study area for visual resources analyses.

The vast majority of the site (approximately 90%) would be covered by the low profile PV array (approximately eight feet tall or less, see figure 3-6 for an example) with inverter/transformer blocks (approximately ten feet square by ten feet tall) distributed throughout (approximately one per eight acres). Perimeter security fencing (eight feet tall maximum height) could surround the entire site, and permanent outdoor lighting would be fully shielded and downward directed in compliance with the PMRF Dark Skies Program Requirements.

Due to the fairly level terrain of the Mana Plain, and because of its location, distance, and low-profile, the proposed PV array would be only minimally visible to the public from Kaumualii Highway. Potential effects from the Proposed Action on the scenic roadway corridor along Kaumualii Highway include the removal of vegetation from the proposed PV sites, and construction of the proposed substation and BESS facilities at the Tartar Drive and Lighthouse Road locations indicated in Figure 2-3. The substation and BESS facilities could be visible from Kaumualii Highway, however, their industrial appearance would be consistent with the existing equipment and support facilities that define the visual characteristics of the Sunrise Shrimp Farm (that lies between the highway and the proposed PV sites). New transmission lines and poles would be extended along Tartar Drive and Lighthouse Road from the proposed PV substations to the existing KIUC 57kV transmission line along Kaumualii Highway. The new poles and lines are not expected to result in negative visual impacts since their appearance would be consistent with the existing distribution lines and poles which currently exist in both corridors.

The decommissioning process would remove Proposed Action structures and improvements, and would return the project sites to their existing open space condition.

Therefore, implementation of the Proposed Action would not result in significant impacts to visual resources.

3.8 Airspace

This discussion of airspace includes current uses and controls of the airspace. The Federal Aviation Administration (FAA) manages all airspace within the United States and the U.S. territories. Airspace, which is defined in vertical and horizontal dimensions and also by time, is considered to be a finite resource that must be managed for the benefit of all aviation sectors including commercial, general, and military aviation.

PV systems introduce the possibility of light being reflected off the surface of the PV panels, into the eyes of individuals. In their Technical Guidance for Evaluating Selected Solar Technologies on Airports (2010), the FAA writes, "The potential impacts of reflectivity are glint and glare[6] which can cause a brief loss of vision (also known as flash blindness)." However, solar PV systems employ glass panels that are designed to maximize light absorption and minimize reflection. The panels are constructed with dark, light-absorbing materials and covered with an anti-reflective coating which reflect as little as 2 percent of the incoming sunlight depending on the angle of the sun (FAA, 2010). However, there is the potential for glint and glare to impact air traffic, specifically pilots and air traffic controllers (NAVFAC, 2015). PV systems do not generally pose a glint and glare risk for the general public as individuals must view the panels from a higher elevation to gain the angle of reflection needed to experience glare impacts.

3.8.1 Regulatory Setting.

Specific aviation and airspace management procedures and policies to be used by the Navy are provided by OPNAVINST 3710.7, *Naval Aviation Training and Operating Procedure Standardization*. Other applicable regulations regarding special use airspace management include FAA Order 7490, *"Policies and Procedures for Air Traffic Environmental Actions;"* FAA Order 7610.4H, *"Special Military Operations;"* and the *Memorandum of Understanding Between the Federal Aviation Administration and the Department of the Defense Concerning Special Use Airspace Environmental Actions* (January 26, 1998).

In October 2013, the FAA released an interim policy for solar energy system projects on federally-obligated airports. Under this policy, the FAA specifies that glint and glare impacts to airport facilities must be limited to "no potential" for glint glare impacts at air traffic control towers, and "no potential" for glare or "low potential for after image" along the final approach path for any existing or planned landing threshold (FAA, 2013). The FAA also identified the Solar Glare Hazard Analysis Tool (SGHAT) as the acceptable tool to be used to determine glare impacts and requires that it be used to demonstrate compliance with the standards for measuring ocular impact for any solar energy system proposed at a federally-obligated airport.

3.8.2 Affected Environment

The Hawaii Department of Transportation manages commercial airports at Lihue and Port Allen, which lie approximately 26 miles east and 11 miles southeast of PMRF-Barking Sands, respectively. Lihue Airport has two runways (6,500 feet x 150 feet), taxiways, aprons, eight gates, navigational aids, an airport traffic control tower, and helipads. Port Allen has a small regional airport with a 2,450-foot runway that primarily services unscheduled air taxis and general aviation (NAVFAC, 2016).

[6] Glint is a momentary flash of bright light, whereas glare is a continuous source of bright light (FAA, 2010).

In 1921, the coastal area known as Barking Sands was set aside for use as an airport by the Territory of Hawaii. The U.S. Army acquired the land in 1940, paved the runway, and named it Mana Airport. The Army acquired additional land in 1941 to expand Mana Airport to 2,058 acres. Private airlines frequently used the airport, and during World War II, the runway was heavily used by the military, especially for aircraft supporting the Battle of Midway. In 1954, the base was designated Bonham Air Force Base. In the early 1960s, the Navy obtained jurisdiction of the base from the Air Force (NAVFAC, 2016).

Runway 16-34 at PMRF-Barking Sands is 6,000 feet in length and oriented in a north-south direction. This 6,000-foot runway is long enough (with arresting gear) to support current day-to-day operations and is regularly used for training by a variety of military aircraft for the Air Force (F-16, C-17, C-5), Army (CH-47), Marine Corps (CH-53, AH-1, UH-1), and Navy (P-3, H-60), as well as Unmanned Aerial Vehicles (NAVFAC, 2016).

Aircraft flights in and out of Barking Sands Airfield are solely related to military missions. The overall number of air operations was 6,947 for 2009 (Navy, 2012). No civilian, commercial, or recreation flights are flown in or out of PMRF. Helicopter tours (i.e., non-military helicopters) are not permitted to fly within airspace over PMRF. The air space surrounding PMRF is designated as Special Use Airspace, and is restricted Monday through Friday from 0600-1800 hours (Navy, 2009).

3.8.3 Environmental Consequences

The analysis of airspace management and use will focus on the potential impacts from glint and glare. The Proposed Action will not impact the types, locations, or frequency of aerial operations, nor will it impact the presence or absence of already designated (controlled) airspace, or the amount of air traffic using or transiting through a given area.

3.8.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would no impacts from glint and glare. Therefore, no significant impacts to airspace would occur with implementation of the No Action Alternative.

3.8.3.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The airspace that could be affected by the Proposed Action is the area including and immediately surrounding PMRF-Barking Sands.

Runway 16-34 is located in the Central Range and Operations part of the base which extends northward from the south end of the runway. At its closest point, Site A lies approximately 1.6 miles from the south end of Runway 16-34, while Site B is about 2.3 miles from the end of the runway. The proposed PV sites do not lie within the airfield clear zone for the Barking Sands Airfield and would not affect existing flight tracks or approach paths to the airfield (NAVFAC, 2016).

The proposed PV sites are currently undeveloped and covered with *kiawe* trees and scrub vegetation which do not create glint or glare effects for aircraft or motorists in the surrounding area. In order to assess the potential for glint and glare effects from proposed PV systems near airports, Sandia National Laboratories initially developed the SGHAT. This tool determines when and where solar glare can occur throughout the year from a proposed PV system as viewed from user-specified observation points (e.g., flight tracks) (SGHAT User Manual, 2014). The tool accounts for PV system configurations (e.g., tilt, orientation, height, etc.) to determine the potential glare impacts.

Since PMRF-Barking Sands airfield is not available for civilian, commercial, or recreational flights, and it is not a federally obligated airport, a glint and glare analysis is not required. However, the Navy has conducted an SGHAT analysis to assess potential glare hazard associated with the Proposed Action. The glare analysis was conducted for applicable runway flight tracks. Also, since the contractor would be selecting the type of racking structure for the proposed PV system, the analysis assessed the potential effects of both fixed and tracking racking structures. An orientation of due south and a tilt of twenty degrees was assumed as they provide the greatest panel efficiency. Table 3-3 provides a summary of the results of the glint and glare analysis. The full glint and glare analysis is provided in Appendix D.

Table 3-3 Glint and Glare Analysis Results

Flight Track	Racking Structure	PV Site	Potential Glint and Glare Effects
Air Traffic Control Tower	Fixed	Site A	No glare predicted
		Site B	No glare predicted
	Tracking	Site A	No glare predicted
		Site B	No glare predicted
Runway 16, Straight Approach	Fixed	Site A	No glare predicted
		Site B	No glare predicted
	Tracking	Site A	No glare predicted
		Site B	No glare predicted
Runway 16, Straight Approach	Fixed	Site A	No glare predicted
		Site B	No glare predicted
	Tracking	Site A	No glare predicted
		Site B	No glare predicted
Runway 34, Straight Approach	Fixed	Site A	No glare predicted
		Site B	No glare predicted
	Tracking	Site A	No glare predicted
		Site B	No glare predicted
Runway 34, Curved Approach	Fixed	Site A	Glare with potential for temporary after-image predicted (between 6:00 and 8:00 a.m.) in March, April, May, August September, and October
		Site B	Glare with potential for temporary after-image predicted (between 6:00 and 8:00 a.m.) in March, April, May, August, September, and October
	Tracking	Site A	Glare with potential for temporary after-image predicted (between 6:00 and 7:00 p.m.) in March and September
		Site B	Glare with potential for temporary after-image predicted (between 6:00 and 7:00 p.m.) in March and September

The SGHAT analysis shows generally, there would be no effect except for aircraft on a curved approach to Runway 34. The analysis identifies that glare with a potential for temporary after-image would be limited to a two hour period between 6:00 a.m. and 8:00 a.m. during the months March, April, May, August, September, and October if a fixed racking structure was chosen for the PV arrays, or a one hour period between 6:00 p.m. and 7:00 p.m. during the months of March and September if a tracking racking structure was chosen. The intensity and duration of the potential glare effects would vary based on the time of the year (i.e., the sun's location in the sky) and local weather, but the potential effects would not exceed the time ranges provided.

The decommissioning of the PV systems would remove any potential effects from glint and glare.

Therefore, implementation of the Proposed Action would not result in significant impacts to airspace.

3.9 Noise

This discussion of noise includes the types or sources of noise and the associated sensitive receptors in the human environment. Noise in relation to biological resources and wildlife species is discussed in the Biological Resources section.

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water, and are sensed by the human ear. Sound is all around us. The perception and evaluation of sound involves three basic physical characteristics:

- Intensity – the acoustic energy, which is expressed in terms of sound pressure, in decibels (dB)
- Frequency – the number of cycles per second the air vibrates, in Hertz (Hz)
- Duration – the length of time the sound can be detected

Noise is defined as unwanted or annoying sound that interferes with or disrupts normal human activities. Although continuous and extended exposure to high noise levels (e.g., through occupational exposure) can cause hearing loss, the principal human response to noise is annoyance (see Appendix XX, Noise). The response of different individuals to similar noise events is diverse and is influenced by the type of noise, perceived importance of the noise, its appropriateness in the setting, time of day, type of activity during which the noise occurs, and sensitivity of the individual. While aircraft are not the only sources of noise in an urban or suburban environment, they are readily identified by their noise output and are given special attention in this EA.

3.9.1 Basics of Sound and A-weighted Sound Level

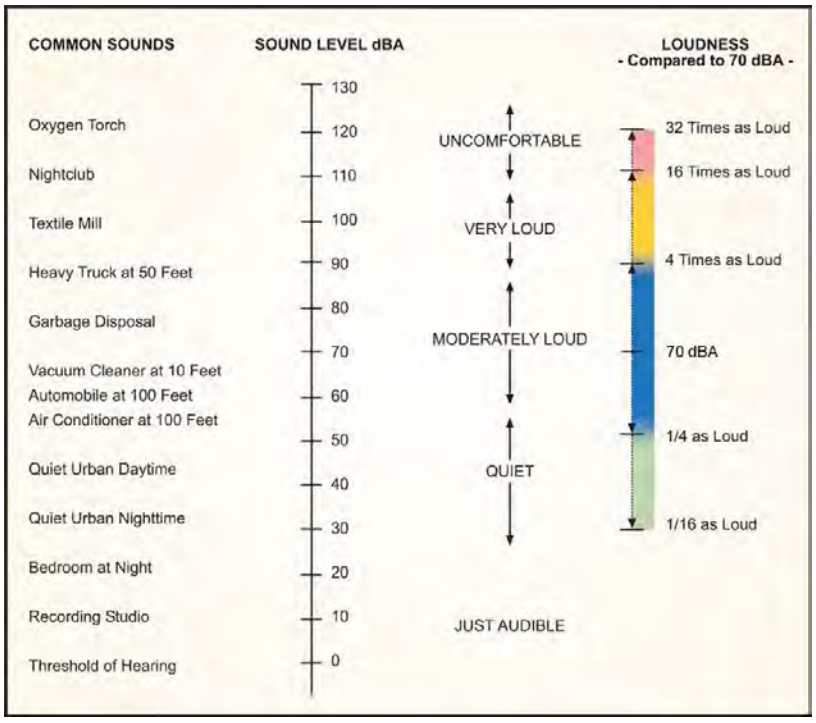
The loudest sounds that can be detected comfortably by the human ear have intensities that are a trillion times higher than those of sounds that can barely be detected. This vast range means that using a linear scale to represent sound intensity is not feasible. The dB is a logarithmic unit used to represent the intensity of a sound, also referred to as the sound level. All sounds have a spectral content, which means their magnitude or level changes with frequency, where frequency is measured in cycles per second or Hz. To mimic the human ear's non-linear sensitivity and perception of different frequencies of sound, the spectral content is weighted. For example, environmental noise measurements are usually on an "A-weighted" scale that filters out very low and very high frequencies in order to replicate human sensitivity. It is common to add the "A" to the measurement unit in order to identify that the measurement has been made with this filtering process (dBA). In this document, the dB unit refers to A-weighted sound levels. Table 3.4 provides a comparison of how the human ear perceives changes in loudness on the logarithmic scale.

Table 3-4. Subjective Responses to Changes in A Weighted Decibels

Change	*Change in Perceived Loudness*
3 dB	Barely perceptible
5 dB	Quite noticeable
10 dB	Dramatic – twice or half as loud
20 dB	Striking – fourfold change

Figure 3.7 provides a chart of A-weighted sound levels from typical noise sources. Some noise sources (e.g., air conditioner, vacuum cleaner) are continuous sounds that maintain a constant sound level for some period of time. Other sources (e.g., automobile, heavy truck) are the maximum sound produced during an event like a vehicle pass-by. Other sounds (e.g., urban daytime, urban nighttime) are averages taken over extended periods of time.

Noise levels from aircraft operations that exceed background noise levels at an airfield typically occur beneath main approach and departure corridors, in local air traffic patterns around the airfield, and in areas immediately adjacent to parking ramps and aircraft staging areas. As aircraft in flight gain altitude, their noise contributions drop to lower levels, often becoming indistinguishable from the background noise.



Sources: Derived from Harris (1979) and Federal Interagency Committee on Aviation Noise (1997).

Figure 3-7 A-Weighted Sound Levels from Typical Sources

3.9.2 Affected Environment

The predominant noise sources in the project area consist of traffic noise associated with vehicles traveling along Kaumualii Highway, Tartar Drive, Nohili Road, and Kokole Point Road. Other components such as noise from airfield operations, construction activities on the base, and missile range operations produce noise, but given the location of the PV sites such noise generally represents a transitory and negligible contribution to the average noise level environment. The federal government supports conditions free from noise that threaten human health and welfare and the environment. Response to noise varies, depending on the type and characteristics of the noise, distance between the noise source and whoever hears it (the receptor), receptor sensitivity, and time of day. A noise sensitive receptor is defined as a land use where people involved in indoor or outdoor activities may be subject to stress or considerable interference from noise. Such locations or facilities often include residential dwellings, hospitals, nursing homes, educational facilities, and libraries. Sensitive receptors may also include noise-

sensitive cultural practices, some domestic animals, or certain wildlife species. The noise-sensitive receptor closest to Site A is the NGIS along Tartar Road, which lies about 385 feet to the west, while the receptor nearest to Site B is the NGIS along Kokole Point Road, which is approximately 100 feet to the south.

3.9.2.1 Aircraft Noise

Relatively loud, intermittent sources of noise on PMRF include airfield and range operations, and missile launches. Wind, surf, wildlife, and road traffic are sources of ambient noise. Airfield operations include take-offs and landings of fixed-wing craft and helicopters, as well as engine maintenance activities. Airfield noise contours have been created based on modeling aircraft operations in 2004 and projected operations in 2009 (Navy, 2006). Missile launches are another source of relatively loud noise at PMRF. Missile launches occur regularly from the Kauai Test Facility and PMRF Launch Area which are located in the Range and Airfield Operations area in the northern part of the base. Launches from these sites typically produce sound levels of between 92 and 115 dBA in A-weighted decibels (Navy, 1998). The South Launch Site is located at the end of Kokole Point Road approximately 2,170 feet west of Site B at its closest point.

3.9.2.2 On-Shore Noise

The level of ambient noise is an important indicator of environmental quality. Noise from vehicle traffic, aircraft flights, and industrial land uses, and construction activities can impact ambient noise levels based on their proximity to noise-sensitive receptors (e.g., occupied structures). Chronically high noise levels can impact personal health and quality of life in an area.

Noise-sensitive receptors bordering the proposed PV sites include the NGIS along Tartar Drive about 385 feet west of Site A, and the NGIS along Kokole Point Road about 150 south of Site B. Other noise sensitive receptors in the project area are located around and *makai* of the intersection of Tartar Drive and Nohili Road and include the base's Community Support Complex, Bachelor Enlisted Quarters, Child Development Center, and Family Housing area.

3.9.3 Environmental Consequences

Analysis of potential noise impacts includes estimating likely noise levels from the Proposed Action and determining potential effects to sensitive receptor sites.

3.9.3.1 No-Action Alternative

Under the No-Action Alternative, the Proposed Action would not occur and there would be no change to baseline noise levels. Therefore, no significant impacts due to the noise environment would occur with implementation of the No-Action Alternative.

3.9.3.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The noise study area for the Proposed Action encompasses areas in the vicinity of the Proposed Action, including noise sensitive receptors such as the NGIS facilities along Tartar Drive and Kokole Point Road.

The noise environment at the project site is characterized by ambient sources of noise from vehicular traffic and occasional construction activities on base, as well as loud intermittent sources of noise from airfield and range operations, including missile launches. The Proposed Action would have minor, short-term impacts on ambient noise levels during the construction period. However, these construction

period impacts would be consistent with other construction activities on base, and would be less than the existing intermittent noise impacts from airfield and range operations and missile launches.

Construction noise may temporarily affect the occupants of noise-sensitive receptors in the vicinity of the PV sites. Noise from construction vehicles, machinery, equipment, and power tools would be the dominant source of construction noise, and the NGIS and THAAD facilities bordering the PV sites and the adjacent Sunrise Shrimp Farm would be the most susceptible to noise impacts. However, measures would be implemented to minimize noise including the use of sound-dampening devices (e.g., baffles, mufflers) and properly maintaining all equipment, vehicles, and machinery. The contractor would be responsible for compliance with all applicable regulatory requirements for noise control, including Chapter 11-46, Hawaii Administrative Rules (HAR) regarding Community Noise Control for potential noise impacts to non-federal properties. Construction activities will typically be carried out during daylight hours.

During the operational period, the PV system components would make little or no sound except for noise from cooling fans in the inverters and a low hum from transformers mounted on each equipment pad and at the substations. If a tracking mounting system were selected, there would be minor noise associated with the PV array as it tracks the sun across the sky. Vehicles used for periodic maintenance activities would generate noise on a limited, temporary basis. The operation of the PV systems is not expected to result in significant noise impacts to the installation facilities in the vicinity of the PV sites or to the Sunrise Shrimp Farm adjacent to the sites.

During the decommissioning process, noise from the removal of structures and improvements, and emissions from vehicles and equipment used to perform this work would be temporary in duration. BMPs such as those utilized during the construction phase would be implemented as necessary to minimize work-related noise.

Therefore, implementation of the Proposed Action would not result in significant impacts to the noise environment.

3.10 Infrastructure

This discussion of infrastructure focuses on electrical power, potable water, stormwater drainage, and solid waste management. Wastewater collection and communications (cable, fiber optic, and phone service) are not included in this analysis as discussed on Page 3-3. Roadway systems and traffic are addressed separately in Section 3.10.

3.10.1 Affected Environment

The following discussions provide a description of the existing conditions for each of the categories under infrastructure at PMRF-Barking Sands.

3.10.1.1 Electrical Power

The proposed PV sites are undeveloped, so no electrical service is currently provided to the sites. However, utility poles with overhead distribution lines are located adjacent to the site along Tartar Drive, Nohili Road, and Kokole Point Road to provide electrical service to properties in the vicinity of the Proposed Action.

PMRF purchases electricity from the KIUC to power base operations. Power to PMRF-Barking Sands is supplied by KIUC's 57kV transmission line between their Mana Substation and the Kekaha Switchyard

(Navy, 2009). Approximately 2 MW of power are required for normal, day-to-day operations. However, certain missions require significantly higher power for short durations. To improve energy flexibility and resilience at PMRF, an approved and upcoming grid consolidation project (P-416) would connect three of the four existing grids at Barking Sands into one continuous system to improve energy security for critical range operations, enable renewable resources to meet load requirements, and help to meet the station's energy goals. Grid consolidation allows power transfer from areas that produce excess renewable energy to other grids on the installation, thus increasing overall system efficiency and reducing energy costs (NAVFAC, 2016). The grid consolidation project would include undergrounding some electrical distribution lines and constructing a new switching station along Tartar Drive which could be collocated with the PV substation on Site A.

PMRF operates back-up diesel generators dedicated to mission-critical and emergency functions at the Main Base and the Makaha Ridge Tracking Station. In the event of a power outage from KIUC, Barking Sands has two 600 kilowatt (kW) and three 300 kW diesel-powered generator units. Other generating units are located around the base to support specific infrastructure. A 750 kilovolt amperes (kVA) standby generator is located at Makaha Ridge Tracking Station, and facilities at Kokee are also support by backup power. Some PMRF facilities have rooftop PV systems to supplement the base's electricity requirements (NAVFAC, 2016).

An Advanced Metering Infrastructure project for PMRF-Barking Sands was awarded in 2009 to install 99 advanced meters to comply with the Energy Policy Act 2005, Energy Independence and Security Act 2007, and American Recovery & Relief Act mandates. In March 2015, Executive Order 13639, Planning for Federal Sustainability in the Next Decade, included the requirement to promote building energy conservation, efficiency, and management by installing and monitoring advanced energy meters in all data centers by FY18 (NAVFAC, 2016).

3.10.1.2 Potable Water

The Kauai County Department of Water (KDOW) is a semi-autonomous agency responsible for the management, control and operation of the island's municipal water system. It supplies water to 13 geographic areas, each of which is served by a single system or linked subsystems. The Kekaha area is served by the department's Waimea-Kekaha subsystem (DLNR, 2016). KDOW and an off-base well (Mana Well) owned by Manu Kai, LLC provide potable water to PMRF-Barking Sands. Potable water at Barking Sands primarily comes from the Mana Well, located south of Kamokala Ridge. Water from the well is transferred via an 8-inch main to Building 394, where it is chlorinated and treated with fluoride, and then pumped to nearby storage tanks for distribution to all areas of the base. County water service is also available via a connection to storage tanks and a pump house located at the Kokole Gate, but minimally used due to cost (NAVFAC, 2016). Existing water lines are located along all roadways adjacent to the Proposed Action, including Tartar Drive, Nohili Road, Kokole Point Road, and the access Driveway to the THAAD Facility.

3.10.1.3 Stormwater Drainage

Infrastructure to manage stormwater at PMRF-Barking Sands is comprised of grass and concrete drainage ditches/swales, drainage intake structures, and pipe culverts. There are no drainage improvements on the PV sites. Runoff from PV sites follows existing drainage patterns and sheet flows onto low lying areas where it dissipates through evaporation, transpiration or percolation.

3.10.1.4 Solid Waste Management

In FY 2006, PMRF generated 530.6 tons of waste that was sent to the Kekaha Landfill, or approximately less than 1% of the annual waste received by the landfill. PMRF also recycled an additional 252.2 tons of material (e.g., aluminum, glass, paper, cans, and cardboard) and collects and composts green waste (i.e., yard clippings and natural materials) for reuse on base (Navy, 2009).Solid waste from PMRF is disposed of at the 64-acre Kekaha Municipal Solid Waste Landfill (MSWLF). This County-owned, privately-operated facility lies south of, and adjacent to Site B.

The Kekaha MSWLF is nearing capacity and the County of Kauai has completed a Final Environmental Assessment/Environmental Impact Statement Preparation Notice (FA/EISPN) to construct a new landfill and resource recovery park at Maalo on the east side of the island. The County's 2013 FEA/EISPN provides the following description of the existing Kekaha MSWLF:

> "Kekaha MSWLF has been operated in two phases. Phase I reached capacity years sooner than anticipated due to a sharp increase in solid waste disposal following Hurricane Iniki in 1992. Phase II opened in 1993 and is approaching its design capacity. In 1998, the maximum height of the Phase II landfill was increased to 60 feet (ft) above mean sea level (msl). Since that time, the County has implemented an additional vertical expansion to 85 ft msl and a horizontal expansion ("Cell 1"). The County is currently designing and attempting to permit an additional horizontal expansion ("Cell 2"), which is expected to extend the useful life of the existing landfill for several additional years."

The County is currently drafting the EIS for the Maalo MSWLF, and they have recently released a Traffic and Roadways Engineering Feasibility Study. This study identifies 2020 as the projected opening year for the Maalo MSWLF. The FEA/EISPN estimates that the new facility could be developed in three phases and would have a total site life of 264 years.

3.10.2 Environmental Consequences

This section analyzes the magnitude of anticipated increases or decreases in public works infrastructure demands considering historic levels, existing management practices, and storage capacity, and evaluates potential impacts to public works infrastructure associated with implementation of the alternatives. Impacts are evaluated by whether they would result in the use of a substantial proportion of the remaining system capacity, reach or exceed the current capacity of the system, or require development of facilities and sources beyond those existing or currently planned.

3.10.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to the existing infrastructure of PMRF. Therefore, no significant impacts to transportation, utilities, or facilities would occur with implementation of the No Action Alternative.

3.10.2.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The study area for infrastructure includes the infrastructure systems that serve the project site.

Electrical Power

To connect the PV substations to the KIUC transmission line along Kaumualii Highway, the Proposed Action would require the installation of new overhead transmission lines. These new transmission lines could be placed on new utility poles adjacent to the existing overhead utility lines, or new utility poles could replace the existing poles and the new transmission lines and the existing utility lines could all be

strung on the new poles. The layout and installation of the new electrical lines and equipment required to service the proposed PV systems would be coordinated with KIUC to ensure that all applicable design and operational criteria are addressed. Construction drawings would be prepared during final engineering design and submitted to KIUC for review and approval prior to the commencement of construction. During the operational period, the PV systems would have a positive overall effect on Kauai's environment and energy use since it would help reduce the amount of fuel oil that is burned for power generation and reduce the island's dependence on foreign oil and fossil fuels. In addition to providing clean, renewable energy, the Proposed Action would contribute to meeting the renewable energy goals established by SECNAV, the federal government, and the State of Hawaii.

Potable Water

Potable water from the KDOW and/or Manu Kai systems would be required for PV panel maintenance and to provide fire protection for the BESS and substation complex at each PV site. Accordingly, the Proposed Action would require connection to the existing 8-inch water line within the Nohili Road ROW. The layout and installation of the new water lines would be coordinated with the appropriate potable water provider to ensure that all applicable design and operational criteria are addressed. Construction drawings would be prepared during final engineering design and submitted to the water service provider for review and approval prior to the commencement of construction. During the operational period, the potable water would be used for periodic cleaning of the PV panels and provide fire protection for the BESS and substation complex at each PV site. In the long term, the operation and maintenance of the PV systems would not have a significant impact on potable water systems.

Stormwater Drainage

Construction of the PV systems would alter existing drainage and groundwater recharge conditions through the introduction of impervious surfaces. However, the increase in runoff, and subsequent decrease in groundwater recharge for each PV site is expected to be minimal as the impervious surfaces would be limited to the mounting systems for the PV arrays, equipment pads, and substation complex. These impervious surfaces represent a relatively small area when compared to the overall land area of each site. BMPs would be implemented, and retention basins or dry wells would be utilized as necessary, to ensure that stormwater runoff is retained on site and allowed to percolate into the ground or be discharged at a rate that would not exceed predevelopment runoff or negatively impact adjacent and downstream properties. An NPDES Permit for stormwater discharge associated with construction activities would be obtained where site work (grubbing, grading) is 1-acre or more. During the operational period, the PV systems would require minimal maintenance which would involve periodically washing the PV panels with water to remove accumulated dust and dirt. These activities would be limited in duration and would not involve discharges that have the potential to affect surface or groundwater quality.

Solid Waste Disposal

The Proposed Action would initially require the disposal of green waste from site clearing activities and the disposal of construction waste material. During the construction phase, the disposal of green waste and construction waste materials would be the responsibility of the PV contractor. If feasible, green waste generated from the site clearing activities could be mulched in place and used to control ground vegetation. Alternatively, the green waste could be transported to the Lihue Green Energy Biomass Plant, which burns wood chips to generate electricity for KIUC. If neither of those options are feasible, the contractor could transport the cleared vegetation to an authorized disposal facility for mulching.

Similarly, construction waste materials would be hauled to the appropriate construction and demolition waste disposal facility, and non-hazardous municipal solid waste at the Kekaha MSWLF.

During the operational period, solid waste generated by the operation and maintenance of the PV systems is expected to be very minimal. It would include waste associated with the repair and/or replacement of damaged PV system components and green waste associated with the clearing of vegetation around the PV systems. Proper disposal of solid waste generated during the operational period would be the responsibility of the PV contractor.

During the decommissioning process, there is the potential for a large amount of solid waste to be generated, but solar panel recycling programs are developing and are expected to be more robust as the current boom in solar panel production reaches the end of their useful lives (SEIA, 2014). The disposal of any remaining solid waste generated from decommissioning would be the responsibility of the PV contractor who would hire a commercial waste service to transport the waste to an appropriate disposal facility. At the time of decommissioning, it is anticipated that the Kekaha MSWLF would be closed, so non-hazardous municipal solid waste generated from decommissioning would be disposed of at the Maalo MSWLF.

Therefore, implementation of the Proposed Action would not result in significant impacts to infrastructure.

3.11 Transportation

The discussion of transportation includes all of the air, land, and sea routes with the means of moving passengers and goods. A transportation system can consist of any or all of the following: roadways, bus routes, railways, subways, bikeways, trails, airports, and taxis, and can be looked at on a local or regional scale. The transportation component relevant to the Proposed Action is the local roadway system which is discussed below.

3.11.1 Affected Environment

Kaumualii Highway in the vicinity of PMRF-Barking Sands typically has light vehicular traffic that increases slightly in conjunction with personnel surges to support specific mission events. The PMRF-Barking Sands main gate enters to Tartar Drive and provides direct access to the Personnel Support District (southern portion of the base). The north gate—open only during morning and afternoon rush hour periods—enters to Imiloa Road and provides direct access to the main operational area of the base. Both Tartar Drive and Imiloa Road quickly intersect with Nohili Road, the primary vehicular spine that connects the entire base from north to south. Secondary access roads provide circulation around other portions of the base. Although the Barking Sands is a linear-shaped installation over 7 miles long, buildings are clustered together, which supports efficient vehicular and pedestrian circulation. Parking is available at each specific facility; there are no district parking lots or structures (NAVFAC, 2016).

A well-developed sidewalk network in the Personnel Support District connects most of the facilities with the area. In the north, sidewalks primarily connect parking lots directly to adjacent facilities and do not form a connected network. The Waiokapua Bay Trail is a walking/jogging path that runs from the Major's Bay recreation area parking lot to the All Hands Club. Current plans extend this path to the south end of the base, primarily aligned along Nohili Road (NAVFAC, 2016).

The two arterials that provide ground transportation for the island of Kauai fall under the jurisdiction of the Hawaii Department of Transportation (DOT). Both of these two-lane highways begin in Lihue;

however, Kaumualii Highway (Route 50) proceeds westward to PMRF-Barking Sands, while Kuhio Highway (Route 56) extends to Haena in the northwest part of the island (NAVFAC, 2016). The posted speed limit along the portion of Kaumualii Highway in the vicinity of the project area is 50 mph. Vehicle traffic in the area beyond Kekaha is light due to the fact that there are no large residential areas or major development occurring northwest of the town (DLNR, 2016).

3.11.2 Environmental Consequences

3.11.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to transportation. Therefore, no significant impacts would occur with implementation of the No Action Alternative.

3.11.2.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The transportation study area for the Proposed Action is the segments of Kaumualii Highway and local roadways that extend from Nawiliwili Harbor in Lihue to the PMRF-Barking Sands Main Gate on Tartar Drive.

The Proposed Action would require the use of public roadways to transport construction materials; provide construction and maintenance workers with access to and from the PV sites; and haul green waste and construction waste materials away for disposal. The Proposed Action would also require connection to the existing KIUC 57kV transmission line within the Kaumualii Highway ROW.

The operation and maintenance of the PV systems would require periodic maintenance trips to each site to clean the PV panels, trim overgrown vegetation, and check the PV panels and equipment. Since the PV systems are unmanned facilities, they would not generate additional vehicle trips or involve activities that could potentially affect traffic.

To minimize traffic-related impacts during construction, appropriate traffic management measures would be included in the construction documents to control material deliveries, use of privately owned vehicles on-base, and allowable interruptions in on base traffic. Installation of the proposed transmission line connections in the Kaumualii Highway ROW would be coordinated with the Hawaii DOT. Construction vehicles, equipment, and materials may be stored and secured onsite to minimize vehicle movement. The PV contractor would obtain the necessary approval to transport oversized and/or overweight material on Kauai's roads and highways. Current DoD standoff distance protocols at PMRF would be implemented during construction to ensure that force protection capabilities continue to be maintained.

During the decommissioning process, the use of public roadways would be required to provide workers access to the site and to haul waste to the proper disposal facilities. Traffic management measures, similar to those used during construction, would be implemented to minimize potential impacts to local roadways and traffic.

Therefore, implementation of the Proposed Action would not result in significant impacts to transportation.

3.12 Public Health and Safety

This discussion of public health and safety includes consideration for any activities, occurrences, or operations that have the potential to affect the safety, well-being, or health of members of the public. A safe environment is one in which there is no, or optimally reduced, potential for death, serious bodily injury or illness, or property damage. The primary goal is to identify and prevent potential accidents or impacts on the general public. Public health and safety within this EA discusses information pertaining to community emergency services, construction activities, operations, and environmental health and safety risks to children.

Community emergency services are organizations which ensure public safety and health by addressing different emergencies. The three main emergency service functions include police, fire and rescue service, and emergency medical service.

Public health and safety during construction, demolition, and renovation activities is generally associated with construction traffic, as well as the safety of personnel within or adjacent to the construction zones.

Operational safety may refer to the actual use of the facility or built-out proposed project, or training or testing activities and potential risks to inhabitants or users of adjacent or nearby land and water parcels. Safety measures are often implemented through designated safety zones, warning areas, or other types of designations.

Environmental health and safety risks to children are defined as those that are attributable to products or substances a child is likely to come into contact with or ingest, such as air, food, water, soil, and products that children use or to which they are exposed.

3.12.1 Regulatory Setting

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, requires federal agencies to "make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children and shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks."

3.12.2 Affected Environment

PMRF is responsible for range safety for all flights. Standard operating procedures (SOPs) provide for the safe conduct of range operations. The range control office is responsible for implementing these procedures. Ground Hazard Areas which include on-base and, in some cases, off-base areas have been established for the launching of numerous types of missiles (U.S. Army Strategic Defense Command, 1992; U.S. Department of Energy, 1992). PMRF range operations issues notices to airmen and mariners and conducts surveillance flights to ensure that all flight corridors in warning areas are cleared of people before a launch occurs. Missile launches can be terminated by the Missile Flight Safety Officer if debris is expected to fall outside these hazard areas.

Ground safety considerations at the PMRF include aircraft operations and the operation of radars that pose a potential electromagnetic hazard to aircraft and ground personnel. Operators of those radars have developed SOPs to ensure that safety of aircraft and ground personnel. At PMRF, in addition to the SOPs, all radars are elevated on pedestals which greatly eliminates ground hazards to personnel. In the

southern part of PMRF-Barking Sands, a ground hazard area surrounds the South Launch Site (NAVFAC, 2016). This ground hazard area encompasses nearly the entire area of PV site B.

Fire and security services for the island of Kauai are provided by the Kauai Fire Department (KFD) and Kauai Police Department (KPD), respectively. The KFD has eight fire stations throughout the island including one in Waimea, while the KPD is headquartered in Lihue and maintains substations in Hanalei and Waimea. The Waimea fire station and police substation are located approximately 5.7 miles southeast of PMRF-Barking Sands. PMRF maintains its own police, fire, and emergency medical services. PMRF Crash and Fire Services are located in the Air Traffic Control Tower, Building 300. Ambulance and Class II Emergency Medical Technician services are provided by contractors and are available 24 hours a day, seven days a week.

Health care service for this part of the island is provided by the West Kauai Medical Center (WKMC) in Waimea, approximately 5.6 miles southeast of PMRF-Barking Sands. Located on the WKMC campus, the Kauai Veterans Memorial Hospital is a full service Critical Access Hospital with a hospital outpatient clinic and a medical office building with additional medical services (County of Kauai, 2016).

PMRF facilities in the project area that accommodate children include the NGIS facilities along Tartar Drive and Kokole Road, the Navy Exchange, child development and youth centers, recreational facilities, and family housing area which are located around the intersection of Tartar Drive and Nohili Road.

3.12.3 Environmental Consequences

The safety and environmental health analysis contained in the respective sections addresses issues related to the health and well-being of military personnel and civilians living on or in the vicinity of PMRF-Barking Sands. This section provides information on man-made constraints at PMRF-Barking Sands that could potentially affect individual health and safety. Specifically, this section provides information on ordnance storage safety distances; ground hazard areas; and construction, operations, and decommissioning of the Proposed Action. Additionally, this section addresses the environmental health and safety risks to children.

3.12.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to public health and safety. Therefore, no significant impacts would occur with implementation of the No Action Alternative.

3.12.3.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The public health and safety study area for the Proposed Action is the footprint of the proposed PV systems.

Explosive Safety Quantity Distance (ESQD) arcs describe the acceptable safe distance between a potential explosion site (i.e. ordnance storage or handling site) and an exposed site (i.e. inhabited building or public transportation route.) Ammunition and bulk explosives are stored in magazines specifically designed, sited, and designated for this purpose. The project area is located well outside of ESQD Arcs.

Ground hazard areas have been established at PMRF-Barking Sands. Missile flight safety procedures require that the public and non-essential mission personnel be excluded from certain areas to protect them in the unlikely event of any early flight termination. In the southern part of PMRF-Barking Sands, a

ground hazard area surrounds the South Launch Site (NAVFAC, 2016). This ground hazard area encompasses nearly the entire area of PV site B. Although the South Launch Site is used infrequently, the Navy would coordinate missile launching activities at this site with the PV contractor and KIUC to avoid potential ground hazard area impacts during construction or maintenance work at the PV sites.

The Proposed Action does not pose a risk to public health and safety as access to PMRF is restricted and entry to the PV sites would be controlled by the operator of the PV systems and limited to maintenance purposes.

The Proposed Action would be an unmanned facility which would not extend the service area limits for police, fire and rescue, and emergency medical service nor would it create a need or demand for new or additional public services.

Executive Order 13045 (April 21, 1997) and its policies, programs, activities, and standards requires federal agencies to make it a high priority to identify and address disproportionate risks to children that result from environmental health or safety risks. During construction, access to each PV site would be restricted to authorized personnel. Temporary fences and other access control measures would be utilized to prevent accidental entry by children or other individuals who reside or work in the area. After its completion, the PV systems could be screened from children living or playing in the surrounding area by fences and locked gates to prevent accidental entry and exposure to electrocution or other safety and health hazards. Because the PV systems would be located on DoD property, there would be no exposure and risk to the general public. The Proposed Action is not expected to generate disproportionate environmental health or safety risks for children living near the PV sites.

During the decommissioning process, the Navy would coordinate the scheduling of South Launch site activities with the PV contractor and KIUC to avoid potential ground hazard area impacts during construction or maintenance work at the PV sites.

Therefore, implementation of the Proposed Action would not result in significant impacts to public health and safety.

3.13 Hazardous Materials and Wastes

This section discusses hazardous materials, hazardous waste, toxic substances, and contaminated sites.

3.13.1 Regulatory Setting

Hazardous materials are defined by 49 CFR section 171.8 as “hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table, and materials that meet the defining criteria for hazard classes and divisions” in 49 CFR part 173. Transportation of hazardous materials is regulated by the U.S. Department of Transportation regulations.

Hazardous wastes are defined by the Resource Conservation and Recovery Act, as amended by the Hazardous and Solid Waste Amendments, as: “a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (A) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.” Certain types of hazardous wastes are subject to special management provisions intended to ease the management burden and facilitate the recycling of such materials. These are called universal

wastes and their associated regulatory requirements are specified in 40 CFR part 273. Four types of waste are currently covered under the universal wastes regulations: hazardous waste batteries, hazardous waste pesticides that are either recalled or collected in waste pesticide collection programs, hazardous waste thermostats, and hazardous waste lamps.

Special hazards are those substances that might pose a risk to human health and are addressed separately from other hazardous substances. Special hazards include asbestos-containing material, polychlorinated biphenyls, and lead-based paint. The USEPA is given authority to regulate special hazard substances by the Toxic Substances Control Act. Asbestos is also regulated by USEPA under the Clean Air Act, and the Comprehensive Environmental Response, Compensation, and Liability Act.

3.13.2 Affected Environment

The Navy has implemented a strict Hazardous Material Control and Management Program and a Hazardous Waste Minimization Program for all activities. These programs are governed Navy-wide by applicable OPNAV instructions and at the installation by specific instructions issued by the Base Commander. The Navy continuously monitors its operations to find ways to minimize the use of hazardous materials and to reduce the generation of hazardous wastes. PMRF-Barking Sands has four installation restoration program sites, all of which are located in the northern part of the installation near the airfield (PMRF, 1998). There are no contaminated sites identified in the vicinity of the project area.

3.13.3 Environmental Consequences

The hazardous materials and wastes analysis contained in the respective sections below address issues related to the use and management of hazardous materials and wastes as well as the presence and management of specific cleanup sites at PMRF.

3.13.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change associated with hazardous materials and wastes. Therefore, no significant impacts would occur with implementation of the No Action Alternative.

3.13.3.2 Photovoltaic and Battery Energy Storage Systems (Proposed Action) Potential Impacts

The hazardous materials and wastes study area for the Proposed Action is the footprint of the proposed PV systems.

During the construction phase, the PV contractor shall be responsible for ensuring that temporary, secondary containment measures are employed, to ensure that any accidental releases of hazardous substances (e.g., anti-freeze, petroleum, oils, and lubricants) are prevented or limited in scope. Portable catch basins, portable containment berms, and other similar measures would be used for refueling equipment. The PV contractor would ensure that spill kits are kept on site to ensure that response and cleanup actions are promptly undertaken should a spill occur. Construction workers would be trained on spill prevention and notification measures in accordance with DoD pollution control requirements to reduce the potential for accidental spills.

During operations and maintenance, the equipment associated with PV systems do not generally pose a hazardous waste threat. However, coolant used in inverters and mineral oil used in transformers are

considered hazardous substances. Both the inverters and transformers utilize closed systems, and the hazardous materials could only be spilled if there was physical damage to the equipment.

The batteries used in the BESS would contain hazardous substances. Lead-acid, sodium sulfur, and lithium-ion batteries represent the more robust technologies available, however, the specific battery technology used for the proposed system would be decided during the project design process. Batteries are typically housed entirely within a battery container system (BCS), and multiple BCS could be located within a BESS main building or open to the environment. The BCS could include the container, battery enclosures, control system, internal wiring, cooling system, fire suppression system, battery rack system and interfaces for battery management system.

In response to the growing demand for energy storage systems, including BESS, the DoE has recently released an Energy Storage Safety Strategic Plan (2014). In the plan they outline two basic sets of controls that should be used to minimize risks associated with BESS. Engineered controls provide the first step in ensuring the safety of a BESS and include designing the system to the highest possible level of safety. Administrative controls includes the implementation of emergency preparedness plans and the appropriate facility signage, processes, and procedures (DoE 2014).

During the design, construction, and operation of the PV systems, including the BESS, the contractor would be required to implement both engineering and administrative controls to minimize the risk of hazardous substance release.

During the decommissioning process, appropriate measures would be implemented to control any hazardous materials or waste, including the proper disposal or recycling of batteries and PV panels.

Therefore, implementation of the Proposed Action would not result in significant impacts with hazardous materials and wastes.

3.14 Summary of Potential Impacts to Resources and Impact Avoidance and Impact Avoidance and Minimization

A summary of the potential impacts associated with the Proposed Action and the No Action Alternative and impact avoidance and minimization measures are presented in Tables 3-4 and 3-5 respectively. Table 3-5 provides a comprehensive list of all mitigation requirements associated with the Proposed Action.

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Table 3-6 Summary of Potential Impacts to Resource Areas

Resource Area	*No Action Alternative*	*Proposed PV Photovoltaic and Battery Energy Storage Systems*
Air Quality	Continued reliance on fossil fuel power sources and the associated GHG emissions and effects.	Construction: Less than significant impacts. Temporary, less than significant impacts from construction vehicle and equipment emissions and fugitive dust. Best management practices (BMPs) including dust fences, water wagons and/or sprinklers would be used to control fugitive dust emissions during construction. Operations: Beneficial impacts. Vehicular emissions from occasional trips to the PV sites for system maintenance would have a minimal impact on air quality. Decrease in GHG emissions due to the reduction of fossil fuel used to produce electricity would have a long-term beneficial impact.
Water Resources	No impact	Construction: Less than significant impacts. Hazardous materials (coolants, fluids, oils) from equipment, machinery, and vehicles could contaminate groundwater. BMPs such as proper storage of hazardous materials and immediate cleanup of leaks or spills would be implemented to prevent contamination of groundwater resources. Operations: No significant impacts. The unmanned PV systems would only require water for fire protection and periodic cleaning of PV panels.
Geological Resources	No impact	Construction: Less than significant impacts. The fairly flat, previously developed site would require minimal site preparation/grading. Temporary impacts from fugitive dust and soil erosion and sedimentation would be avoided or minimized through BMPs to control dust emissions (see air quality discussion above) and compliance with NPDES permit conditions regarding construction period erosion and sedimentation control. Operations: No significant impacts.

Table 3-6 Summary of Potential Impacts to Resource Areas

Resource Area	*No Action Alternative*	*Proposed PV Photovoltaic and Battery Energy Storage Systems*
Cultural Resources	No impact	Construction and Operations: No significant impacts. Three historic landscape features (Nohili Road, Tartar Drive, and the House Area Gate on Tartar Drive) are located within or adjacent to the proposed project sites. However, the Proposed Action would not affect the character defining features of the roads or the gate. The project sites are located in an area that was previously disturbed and no archaeological sites are anticipated. No archaeological sites or historic structures have been identified in the project area or surrounding area. The Proposed Action would have "no adverse effect" on historic properties under Section 106 of the NHPA.
Biological Resources	No impact	Construction: Less than significant impacts. The Navy has determined that the Proposed Action may affect, but is not likely to adversely affect (NLAA) threatened, or endangered species. Site clearing would remove vegetation, the project site does not include critical habitat for threatened, or endangered vegetation or wildlife. The endangered *nēnē* have been observed on the PV sites. The PV sites could support roosting and/or pupping for the endangered Hawaiian hoary bat. Migratory seabirds, including the threatened Newell's shearwater, endangered Band-rumped Storm-petrel, and endangered Hawaiian petrel could traverse the project area. Appropriate mitigation measures, promulgated by USFWS, would minimize impacts to these endangered species. Operations: Less than significant impacts. Skirting would be placed around the PV arrays as necessary to prevent the shaded area underneath the panels from becoming a habitat for feral animals. To minimize the potential of seabird fallout or disorientation and avoid potential impacts to nocturnal birds, permanent outdoor lighting shall be on motion sensors, fully shielded, downward facing, utilizing light-emitting diodes, and in compliance with PMRF Dark Skies Program Requirements. The proposed transmission line connections could pose a threat to migratory birds which may strike the transmission lines. PMRF personnel will survey the area under the new utility lines to check if nocturnal seabirds collide with the transmission lines, and management strategies will be altered if birds are found to have collided with the new transmission lines.

Table 3-6 Summary of Potential Impacts to Resource Areas

Resource Area	*No Action Alternative*	*Proposed PV Photovoltaic and Battery Energy Storage Systems*
Land use	No impact	Construction and Operations: No significant impacts. The proposed PV systems would be compatible with adjacent land uses, and the State of Hawaii Coastal Zone Management Program has acknowledged receipt of the Navy's notification of the use of the *de minimis* activity list under the Coastal Zone Management Act.
Visual Resources	No impact	Construction and Operations: Less than significant impacts. The proposed PV sites would be minimally visible from public views along Kaumualii Highway. Existing development (landfill, shrimp farm) obstruct views of the PV sites from the public highway. PV sites do not contain scenic features or lie within a public view corridor.
Airspace	No impact	Construction and Operations: Less than significant impacts. The PV sites do not lie within aircraft flight tracks or military runway approach paths. The analysis indicates that no glare impacts would be expected for the air traffic control tower or aircraft on straight approaches to Runways 16 and 34. The glint and glare analysis predicts glare with potential for temporary after-image for the curved approach to Runway 34.
Noise	No impact	Construction: Less than significant impacts. Temporary increase in ambient noise from activities, equipment, machinery and vehicles would be minimized by complying with local noise community control regulations. Operations: No significant impacts. Minimal and very localized noise from cooling fans and transformers.
Infrastructure	No impacts to water, drainage and solid waste disposal, but it does not increase renewable energy generation and it would prolong the existing energy security risks at that results from PMRF's reliance on a single electrical transmission line.	Construction: Less than significant impacts. Temporary impacts to electrical power, water, drainage, and solid waste disposal systems during construction period. Operations: No significant impacts. Minimal impacts to water, drainage, and solid waste disposal systems, and the beneficial impact of increased energy security and stability to the electrical power system.

Table 3-6 Summary of Potential Impacts to Resource Areas

Resource Area	*No Action Alternative*	*Proposed PV Photovoltaic and Battery Energy Storage Systems*
Transportation	No impact	Construction: Less than significant impacts. Vehicle trips by construction workers; deliveries of PV system components; and disposal of construction waste materials would require the use of public roadways. However, appropriate traffic management measures would be implemented to minimize potential impacts to local roadways and traffic. Operations: No significant impacts. The PV systems are unmanned facilities and would not generate consistent vehicle trips. Occasional vehicle trips to the PV sites for system maintenance would have little effect on traffic.
Public Health and Safety	No impact	Construction and Operations: No significant impacts. The PV sites are not affected by ESQD arcs, the Navy would coordinate the ground hazard area from seldom used South Launch Site, and site access controls would ensure safety and health requirements for children.
Hazardous Materials and Wastes	No impact	Construction: No significant impacts. Temporary, secondary containment measures would be employed, to ensure that potential accidental releases of hazardous substances (e.g., anti-freeze, petroleum, oils, and lubricants) are prevented or limited in scope. Operations: No significant impacts. Potential exposure to hazardous materials could occur if inverters or transformers are broken and BESS components could pose a fire hazard. The project would utilize BMPs to minimize the exposure risk in accordance with all applicable regulations.

Table 3-7 Avoidance And Mitigation Measures

Avoidance/Mitigation Measure	*Anticipated Benefit*	*Resources Affected*	*No Action Alternative*	*Proposed PV and BESS Systems*
Implement air quality BMPs; comply with Section 11-60.1, HAR (Fugitive Dust)	Reduce fugitive dust and other particulate emissions	Air Quality	Not Applicable	Applicable
Implement BMPs for stormwater management and sediment control; comply with NPDES permit conditions	Minimize soil erosion and stormwater runoff and sediment and pollutant transport to receiving waters	Water and Geological Resources; Infrastructure (Drainage)	Not Applicable	Applicable
Implement BMPs for site clearing and cut/fill operations	Minimize impacts to topography and soils	Geological Resources	Not Applicable	Applicable
Comply with 2003 Programmatic Agreement for Navy undertakings in Hawaii	Minimize potential impacts to cultural resources	Cultural Resources	Not Applicable	Applicable
Implement standard operating procedures for the handling of inadvertent discoveries of cultural resources (if warranted)	Minimize potential impacts to cultural resources	Cultural Resources	Not Applicable	Applicable
No trees taller than 15 feet would be trimmed or removed during the Hawaiian hoary bat's pupping season which occurs between June 1 and September 30.	Minimize potential impacts to Hawaiian hoary bats.	Biological Resources	Not Applicable	Applicable
Perimeter fencing would not have barbed wire.	Minimize potential impacts to Hawaiian hoary bats.	Biological Resources	Not Applicable	Applicable
Nighttime construction avoided during the seabird fledging period. If nighttime construction occurs during other times of year, all lighting would be shielded and directed toward the ground.	Minimize potential impacts to MBTA species	Biological Resources	Not Applicable	Applicable
Permanent outdoor lighting shall be fully shielded, utilize light-emitting diodes, and comply with PMRF Dark Skies Program Requirements.	Minimize potential impacts to MBTA species.	Biological Resources	Not Applicable	Applicable

Table 3-7 Avoidance And Mitigation Measures

Avoidance/Mitigation Measure	*Anticipated Benefit*	*Resources Affected*	*No Action Alternative*	*Proposed PV and BESS Systems*
PMRF personnel will survey the area under the new utility lines to check if nocturnal seabirds collide with the transmission lines, and management strategies will be altered if birds are found to have collided with the new transmission lines	Minimize potential impacts to MBTA species	Biological Resources	Not Applicable	Applicable
Implement BMPs for minimizing noise during construction; comply with conditions of DOH Construction Noise Permit	Minimize noise impacts to noise-sensitive receptors and uses	Noise	Not Applicable	Applicable
Coordinate traffic control measures with DOT and Kauai Police Department and comply with approved traffic control plan	Minimize traffic congestion impacts	Transportation	Not Applicable	Applicable
Conduct Phase I Environmental Site Assessment (if warranted)	Avoid or minimize worker or public exposure to hazardous materials and wastes	Hazardous Materials and Wastes	Not Applicable	Applicable
Comply with relevant federal, state, and county regulations for storage, handling or disposal of regulated hazardous materials and waste	Avoid or minimize worker or public exposure to hazardous materials and wastes	Hazardous Materials and Wastes	Not Applicable	Applicable
Appropriate worker protection measures during construction	Avoid or minimize worker or public exposure to hazardous materials and wastes	Hazardous Materials and Wastes	Not Applicable	Applicable

4 Cumulative Impacts

This section 1) defines cumulative impacts, 2) describes past, present, and reasonably foreseeable future actions relevant to cumulative impacts, 3) analyzes the incremental interaction the Proposed Action may have with other actions, and 4) evaluates cumulative impacts potentially resulting from these interactions.

4.1 Definition of Cumulative Impacts

The approach taken in the analysis of cumulative impacts follows the objectives of NEPA, CEQ regulations, and CEQ guidance. Cumulative impacts are defined in 40 CFR section 1508.7.

The impact on the environment that results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

To determine the scope of environmental impact statements, agencies shall consider cumulative actions, which when viewed with other Proposed Actions have cumulatively significant impacts and should therefore be discussed in the same impact statement.

In addition, CEQ and USEPA have published guidance addressing implementation of cumulative impact analyses—Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (CEQ 2005) and Consideration of Cumulative Impacts in EPA Review of NEPA Documents (USEPA 1999). CEQ guidance entitled *Considering Cumulative Impacts Under NEPA* (1997) states that cumulative impact analyses should

"…determine the magnitude and significance of the environmental consequences of the Proposed Action in the context of the cumulative impacts of other past, present, and future actions...identify significant cumulative impacts…[and]…focus on truly meaningful impacts."

Cumulative impacts are most likely to arise when a relationship or synergism exists between a Proposed Action and other actions expected to occur in a similar location or during a similar time period. Actions overlapping with or in close proximity to the Proposed Action would be expected to have more potential for a relationship than those more geographically separated. Similarly, relatively concurrent actions would tend to offer a higher potential for cumulative impacts. To identify cumulative impacts, the analysis needs to address the following three fundamental questions.

- Does a relationship exist such that affected resource areas of the Proposed Action might interact with the affected resource areas of past, present, or reasonably foreseeable actions?
- If one or more of the affected resource areas of the Proposed Action and another action could be expected to interact, would the Proposed Action affect or be affected by impacts of the other action?
- If such a relationship exists, then does an assessment reveal any potentially significant impacts not identified when the Proposed Action is considered alone?

4.2 Scope of Cumulative Impacts Analysis

The scope of the cumulative impacts analysis involves both the geographic extent of the effects and the time frame in which the effects could be expected to occur. For this EA, the study area delimits the

geographic extent of the cumulative impacts analysis. In general, the study area would include those areas previously identified in Chapter 3 for the respective resource areas. The time frame for cumulative impacts centers on the timing of the Proposed Action.

Another factor influencing the scope of cumulative impacts analysis involves identifying other actions to consider. Beyond determining that the geographic scope and time frame for the actions interrelate to the Proposed Action, the analysis employs the measure of "reasonably foreseeable" to include or exclude other actions. For the purposes of this analysis, public documents prepared by federal, state, and local government agencies form the primary sources of information regarding reasonably foreseeable actions. Documents used to identify other actions include notices of intent for EISs and EAs, management plans, land use plans, and other planning related studies.

4.3 Past, Present, and Reasonably Foreseeable Actions

This section would focus on past, present, and reasonably foreseeable future projects at and near PMRF-Barking Sands. In determining which projects to include in the cumulative impacts analysis, a preliminary determination was made regarding the past, present, or reasonably foreseeable action. Specifically, using the first fundamental question included in Section 4.1, it was determined if a relationship exist such that the affected resource areas of the Proposed Action (included in this EA) might interact with the affected resource area of a past, present, or reasonably foreseeable action. If no such potential relationship exists, the project was not carried forward into the cumulative impacts analysis. In accordance with CEQ guidance (CEQ 2005), these actions considered but excluded from further cumulative effects analysis are not catalogued here as the intent is to focus the analysis on the meaningful actions relevant to inform decision-making. Projects included in this cumulative impacts analysis are listed in Table 4-1 and briefly described in the following subsections.

Table 4-1 Cumulative Action Evaluation

Action Grouping	*Action*
Past Actions	
Advanced Metering	Advanced Metering • Awarded in 2009 to install 99 advanced energy meters at PMRF-Barking Sands Promotes building energy conservation, efficiency, and management
Present and Reasonably Foreseeable Future Actions	
2016 PMRF Installation Development Plan	Power Grid Consolidation (P-416) • Consolidates electrical grids at PMRF-Barking Sands • Provides pad mounted switchgear • Improves energy security for critical range operations
2016 PMRF Installation Development Plan	1MW PV array (P-417) • Approximately 2-acre site
2016 PMRF Installation Development Plan	Communications Facility • 10,000 sf facility • Backup generator with above-ground storage tank
2016 PMRF Installation Development Plan	Child Development Center • 8,800 sf facility, includes storage requirement 30-stall surface parking lot

Table 4-1 Cumulative Action Evaluation

Action Grouping	*Action*
2016 PMRF Installation Development Plan	Perimeter Security Fence • Chain link fence extends from Kokole Point Road to Naupaka Way • Critical AT/FP infrastructure
2016 PMRF Installation Development Plan	Jogging Path • Crushed coral path (6-foot wide) Extends Waiokapua Trail 3 miles to south end of base
2016 PMRF Installation Development Plan	Static Displays • Install along Tartar Drive by Main Gate
KIUC Renewable Energy Development	50% Renewable Energy Generation by 2023 • Various renewable energy projects across the island in support of this goal.
KIUC Renewable Energy Development	Westside Pumped Hydro Storage Project • 25 MW solar/pumped hydro storage project on the West Side of Kauai, utilizing the Puu Lua Reservoir.
KIUC Renewable Energy Development	Olokele River Hydroelectric Project • Six MW hydropower facility below an existing 1.3 MW plant on Olokele Ditch.
KIUC Renewable Energy Development	Westside Pumped Hydro Storage Project • Dual purpose irrigation and hydroelectric project with a capacity of 1.5 MW. • Project would utilize water from the existing Kekaha Ditch Irrigation System.

4.3.1 Past Actions

4.3.1.1 Advanced Metering

An Advanced Metering Infrastructure project for PMRF-Barking Sands was awarded in 2009 to install 99 advanced meters to comply with the Energy Policy Act 2005, Energy Independence and Security Act 2007, and American Recovery and Reinvestment Act mandates. In March 2015, Executive Order 13639, Planning for Federal Sustainability in the Next Decade, included the requirement to promote building energy conservation, efficiency, and management by installing and monitoring advanced energy meters in all data centers by FY18 (NAVFAC, 2016).

4.3.2 Present and Reasonably Foreseeable Actions

4.3.2.1 2016 PMRF Installation Development Plan

The IDP is the overall long-term development plan for PMRF-Barking Sands and outlying areas. It addresses future land use, circulation and parking, and facility and utility infrastructure development. The IDP identifies and prioritizes development projects for PMRF. This cumulative impacts analysis considers the reasonably foreseeable projects that are proposed in the vicinity of the project area. These projects are identified in Table 4-1.

4.3.2.2 KIUC Renewable Energy Development

KIUC is on the leading edge of renewable energy development. KIUC estimates that 38% of the electricity they generate comes from renewable sources, including solar, hydropower, and biomass.

They have set a goal to reach 50% renewable energy generation by the year 2050. Several projects are currently being proposed, planned, or constructed in order to meet this goal. Three of the proposed projects are located on the west side of Kauai in the vicinity of the Proposed Action. These projects are identified in Table 4-1.

4.4 Cumulative Impact Analysis

Where feasible, the cumulative impacts were assessed using quantifiable data; however, for many of the resources included for analysis, quantifiable data is not available and a qualitative analysis was undertaken. In addition, where an analysis of potential environmental effects for future actions has not been completed, assumptions were made regarding cumulative impacts related to this EA/EIS where possible. The analytical methodology presented in Chapter 3, which was used to determine potential impacts to the various resources analyzed in this document, was also used to determine cumulative impacts.

4.4.1 Air Quality

4.4.1.1 Description of Geographic Study Area

The region of influence (ROI) for assessing air quality impacts is the State of Hawaii.

4.4.1.2 Relevant Past, Present, and Future Actions

The IDP projects could interact with the Proposed Action's air quality resource effects in the short-term if construction of multiple projects occurs concurrently and in the same area. However, this is improbable due to the large, spread-out nature of the Proposed Action and of the development pattern at PMRF in general. Advanced metering, the 1MW PV array, and KIUC's renewable energy goals could interact beneficially with the Proposed Action's air quality resource effects as energy conservation measures and renewable energy generation replace energy generation from fossil fuels.

4.4.1.3 Cumulative Impact Analysis

Short-term cumulative air quality impacts from past, present, and future actions within the ROI would be less than significant because the increase in vehicle emissions associated with the construction of multiple projects would occur in NAAQS attainment areas. Construction period air quality impacts from construction equipment would be temporary and not likely to occur during the same time or at the same location.

Long-term cumulative air quality improvement would be expected from the past, present, and future actions due to the reduction in electricity generation from fossil fuels and the associated emissions. Therefore, implementation of the Proposed Action combined with the past, present, and reasonably foreseeable future projects, would not result in significant air quality impacts within the ROI.

4.4.2 Water Resources

4.4.2.1 Description of Geographic Study Area

The ROI for assessing water resources impacts include the ground water, surface waters, wetlands, and floodplains in the vicinity of the Proposed Action.

4.4.2.2 Relevant Past, Present, and Future Actions

The PMRF IDP projects could interact with Proposed Action's water resource area.

4.4.2.3 Cumulative Impact Analysis

Cumulative water resources impacts from past, present, and future actions within the ROI would be less than significant because all of the projects located within PMRF would be required to comply with their respective permit conditions. In the case of the Proposed Action, BMPs and conditions of the project's NPDES permits would reduce the likelihood of sediments and land-based pollutants from entering surface waters or wetlands. A SWPPP would be prepared for the project, and its conditions and recommendations would be met.

Construction period water resources impacts from these projects due to ground disturbance would be temporary and not likely to occur during the same time or at the same location. Long-term significant impacts from stormwater runoff would be avoided due to the strict stormwater runoff requirements established under Section 438 of the Energy Independence and Security Act of 2007. All of the past, present, or reasonably foreseeable projects with a footprint greater than 5,000 square feet would be required to maintain or restore, the pre-development hydrology of the property with regard to temperature, rate, volume, and duration of flow, to the maximum extent practicable.

The Proposed Action is an unmanned facility, and water would only be used for occasional maintenance and washing of the PV panels. Of the past, present, and reasonably foreseeable projects, only the Communications Facility and the Child Development Center would require water service. These projects would cause minor incremental increases in the demand for water from the KDOW and Manu Kai systems, but the cumulative increase in demand is not expected to result in significant impacts to groundwater resources.

Therefore, implementation of the Proposed Action combined with the past, present, and reasonably foreseeable future projects, would not result in significant water resources impacts within the ROI.

4.4.3 Cultural Resources

4.4.3.1 Description of Geographic Study Area

The ROI for cultural resources cumulative impacts for the Proposed Action is the undertaking's APE described in Section 3.4 (project footprint).

4.4.3.2 Relevant Past, Present, and Future Actions

The PMRF IDP Perimeter Security Fence, Jogging Path, and Power Grid Consolidation projects may interact with the Proposed Action's impacts on cultural resources because the project areas overlap. The Perimeter Security Fence Project and the Proposed Action overlap along the east edge of the proposed PV sites, the jogging path overlaps with the Proposed Action along Nohili Road, and the Power Grid Consolidation Project overlaps with the Proposed Action at the proposed PV Site A substation.

4.4.3.3 Cumulative Impact Analysis

Cumulative impacts to cultural resources from past, present, and future actions within the ROI would be less than significant because no cultural deposits in the overlapping project areas were identified in earlier studies and none are anticipated to be affected by the Proposed Action. The entirety of the Proposed Action, including the project overlap areas is located within an area of low sensitivity for

archaeological resources. The Proposed Action and all of the past, present, and reasonably foreseeable actions would be subject to the requirements of the 2003 PA between the CNRH, SHPO, and ACHP regarding Navy undertakings in the State of Hawaii. In the event there are inadvertent discoveries of historic properties during any project-related activity, all ground disturbing activities would be required to stop in the vicinity of the discovered deposits, and construction would not be resumed until the Navy has completed consultation in accordance with Stipulation XI of the 2003 PA.

Therefore, implementation of the Proposed Action combined with the past, present, and reasonably foreseeable future projects would not result in significant cumulative impacts cultural impacts within the ROI.

4.4.4 Biological Resources

4.4.4.1 Description of Geographic Study Area

The ROI for cumulative impacts to biological resources includes the biological species and habitat present at PMRF-Barking Sands.

4.4.4.2 Relevant Past, Present, and Future Actions

The PMRF IDP projects may interact with the Proposed Action's impacts on biological resources because they may be located in areas that have been identified as habitat for threatened or endangered species, or they may involve the clearing of existing vegetated areas within PMRF-Barking Sands.

4.4.4.3 Cumulative Impact Analysis

Cumulative biological resource impacts from past, present, and future actions within the ROI would be less than significant because they would be managed in accordance with the installations INRMP and none of the proposed projects would be located within an area designated as critical habitat.

The proposed jogging path, perimeter security fence, and the 1MW PV array would require clearing of at least some existing vegetation. However, the vegetation located in these project areas, as well as in the vicinity of the Proposed Action, is identified as mostly kiawe-haole koa scrub vegetation, and there are no known threatened, endangered, or candidate species of terrestrial plant life located in these project areas.

The land area encompassed by the IDP projects and the Proposed Action may support the federally-endangered Hawaiian goose or *nēnē* (*Brandta sandvicensis*). In addition, the federally-endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) may be present in the area and the federally-threatened Newell's shearwater (*puffinus auricularis*) and the federally-endangered Hawaiian petrel (*Pterodroma sandwichensis*) may make overflights of the area during their breeding seasons. The construction of the past, present, and future projects could incrementally contribute to cumulative short-term impacts on threatened and endangered species. However, these projects would be managed in accordance with the Installations INRMP which is designed to protect and benefit threatened and endangered species, and construction would adhere to the best management and avoidance practices discussed in Section 3.7.3. Long-term cumulative impacts associated with the operations of the past, present and future actions are not anticipated as it is assumed that affected terrestrial wildlife could relocate to adjacent undeveloped lands located at PMRF-Barking Sands.

Therefore, implementation of the Proposed Action combined with the past, present, and reasonably foreseeable future projects, would not result in significant impacts within the ROI.

4.4.5 Noise

4.4.5.1 Description of Geographic Study Area

The ROI for cumulative noise impacts is the area that contains noise sensitive receptors closest to the project area.

4.4.5.2 Relevant Past, Present, and Future Actions

The IDP projects may interact with Proposed Action's noise impacts if construction of multiple projects occurs concurrently in the same area.

4.4.5.3 Cumulative Impact Analysis

Cumulative noise impacts from past, present, and future actions within the ROI would be less than significant because BMPs to reduce construction period noise impacts would be utilized, and the concurrent construction of multiple projects in the same area is unlikely to occur.

Short-term, temporary noise impacts are expected from the construction of the Proposed Action and the PMRF IDP projects. However, measures would be implemented to minimize noise including the use of sound-dampening devices (e.g., baffles, mufflers) and properly maintaining all equipment, vehicles, and machinery, and each project would comply with all applicable regulatory requirements for noise control, including Chapter 11-46, Hawaii Administrative Rules (HAR) regarding Community Noise Control. Short-term cumulative impacts associated with the past, present, and future actions are not expected as all of the projects and noise sensitive receptors are located on PMRF-Barking Sands. Therefore, the installation's public works officer would be able to schedule construction projects to minimize the potential of multiple construction projects occurring in the same area at the same time.

Long-term cumulative impacts associated with the operations of the past, present and future actions are not anticipated as none of the projects are expected to generate ambient noise impacts to noise sensitive uses.

Therefore, implementation of the Proposed Action combined with the past, present, and reasonably foreseeable future projects, would not result in significant noise impacts within the ROI.

4.4.6 Infrastructure

The Proposed Action combined with the past, present, or future projects is not expected to generate significant changes to potable water, wastewater, or storm drainage systems. Therefore, this section would focus on the potential cumulative impacts to electrical power infrastructure.

4.4.6.1 Description of Geographic Study Area

The ROI for cumulative impacts to infrastructure includes the electrical power systems that serve the project site.

4.4.6.2 Relevant Past, Present, and Future Actions

Include the past, present, or reasonably foreseeable actions that The Advanced Metering, Power Grid Consolidation, 1MW PV array, Westside Pumped Hydro Storage, and KIUC's renewable energy projects may all interact with the infrastructure impacts of the Proposed Action.

4.4.6.3 Cumulative Impact Analysis

Cumulative infrastructure impacts from past, present, and future actions within the ROI would be beneficial because the projects would enhance the efficiency, security, and stability of the PMRF electrical power system and reduce the amount of power generated by KIUC and PMRF from fossil fuels.

By consolidating three of the four existing grids at PMRF-Barking Sands into one continuous system, the Power Grid Consolidation would improve energy security for critical range operations, enable renewable resources to meet load requirements, and help to meet PMRF's energy goals. The new switching station proposed with the Power Grid Consolidation would allow for the Proposed Action to generate and store electricity to be sold to KIUC for public consumption during normal conditions, but would also allow for the energy to be routed directly to the KIUC grid during contingency situations or times of extreme energy demand at the installation. The Proposed Action and the 1MW PV array would create significant energy generating capacity at PMRF-Barking Sands, and would reduce or minimize the need for PMRF to operate costly diesel generators for mission operations. Coupled with the energy efficiency improvements realized by the Advanced Metering Project, these improvements would create a more efficient, secure, and stable electrical power system at PMRF.

During normal conditions, the power generated by the Proposed Action would be directed to the KIUC grid for public consumption and would contribute to KIUC's goal of reaching 50% renewable energy generation by 2023. The Westside Pumped Hydro Storage Project is another major energy project located on the West side of Kauai which would facilitate KIUC's renewable energy goal. This project is proposed to come on line in 2019 and would store up to 25MW of electricity. The Westside of Kauai is currently served by a 57kV transmission line along Kaumualii Highway, however, upgrades to this transmission line may eventually be required if multiple energy generating facilities, such as the Proposed Action and KIUC's other renewable energy projects are approved. Any required transmission line upgrades would be coordinated by KIUC. The completion of the Proposed Action and the Westside Pumped Hydro Storage Project would have a significant beneficial cumulative impact towards meeting KIUC's renewable energy goals.

Therefore, implementation of the Proposed Action combined with the past, present, and reasonably foreseeable future projects, would result in significant beneficial impacts within the ROI.

5 Other Considerations Required by NEPA

5.1 Consistency with Other Federal, State, and Local Laws, Plans, Policies, and Regulations

In accordance with 40 CFR section 1502.16(c), analysis of environmental consequences shall include discussion of possible conflicts between the Proposed Action and the objectives of federal, regional, state and local land use plans, policies, and controls. Table 5-1 identifies the principal federal and state laws and regulations that are applicable to the Proposed Action, and describes briefly how compliance with these laws and regulations would be accomplished.

Table 5-1 Principal Federal and State Laws Applicable to the Proposed Action

Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	*Status of Compliance*
National Environmental Policy Act (NEPA) (42 U.S.C. section 4321 et seq.); CEQ NEPA implementing regulations (40 CFR parts 1500-1508; Navy procedures for Implementing NEPA ((32 CFR part 775 and OPNAVINST 5090.1D)	EA in progress
Clean Air Act (42 U.S.C. section 7401 et seq.)	Proposed Action in attainment area
Clean Water Act (33 U.S.C. section 1251 et seq.)	NPDES permit to be obtained
Coastal Zone Management Act (16 U.S.C. section 1451 et seq.)	CZM *de minimis* concurrence received
National Historic Preservation Act (Section 106, 16 U.S.C. section 470 et seq.)	Project Notification under the 2003 PA has been submitted
Endangered Species Act (16 U.S.C. section 1531 et seq.)	No effect; no consultation required
Marine Mammal Protection Act (16 U.S.C. section 1361 et seq.)	n/a
Migratory Bird Treaty Act (16 U.S.C. sections 703-712)	n/a
Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (16 U.S.C. section 1801 et seq.)	n/a
Bald and Golden Eagle Protection Act (16 U.S.C. section 668-668d)	n/a
Executive Order 11988, Floodplain Management	n/a
Executive Order 12088, Federal Compliance with Pollution Control Standards	n/a
Executive Order 12114, Environmental Effects Abroad of Major Federal Actions	n/a
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations	EA conclusion of no significant effects
Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks	EA conclusion of no significant effects
Executive Order 13089, Coral Reef Protection	n/a

Table 5-1 Principal Federal and State Laws Applicable to the Proposed Action

Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	*Status of Compliance*
Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management	n/a
Executive Order 13175, Consultation and Coordination with Indian Tribal Governments	n/a
Executive Order 13696, Planning for Federal Sustainability in the Next Decade	n/a

Coastal Zone Management

The Navy/Marine Corps and the State of Hawaii Department of Business, Economic Development and DBEDT, Office of Planning have come to an agreement that certain activities listed on the "Navy/Marine Corps De Minimis Activities under CZMA" (*De Minimis* Activity List) were not subject to further review by the State of Hawaii CZM Program when such an activity was conducted in compliance with the corresponding "Project Mitigation/General Conditions." (DBEDT, July 9, 2009).The Proposed Action to lease land at the West Loch Annex to allow the installation of a PV system falls within Items 1 and 2 on the De Minimis Activity List. The relevant mitigation/conditions are as follows:

(1) All activities would occur on DoD property.

(6) No project-related materials would be stockpiled in the water.

(9) Fueling of project-related vehicles and equipment would take place away from the water. A contingency plan would be established to control accidental petroleum releases during project construction.

(10) All fill material would be protected from erosion as soon as practicable.

(11) All exposed soil would be protected from erosion and stabilized as soon as practicable.

(12) Consultation pursuant to Section 106 of the NHPA would be completed.

(13) No species or habitats protected under ESA would be affected by the Proposed Action.

(14) NEPA EA process would be completed.

(16) State CZM office notified on use of *De Minimis* List for an EA.

The State CZM office acknowledged receipt of notification on October 4, 2016 of usage of the *De Minimis* Activity List and the preparation of this environmental assessment (see CZMA consultation correspondence in Appendix A).

5.2 Irreversible or Irretrievable Commitments of Resources

Resources that are irreversibly or irretrievably committed to a project are those that are used on a long-term or permanent basis. This includes the use of non-renewable resources such as metal and fuel, and natural or cultural resources. These resources are irretrievable in that they would be used for this project when they could have been used for other purposes. Human labor is also considered an irretrievable resource. Another impact that falls under this category is the unavoidable destruction of natural resources that could limit the range of potential uses of that particular environment.

Irreversible resources that would be consumed by the Proposed Action include energy needed to manufacture the PV system components (e.g., PV panels, cables, batteries, and inverters); transport the

components from the manufacturer to the PV sites; and operate the construction equipment to install the PV systems. Other irreversible resource commitments include materials needed to manufacture the PV components. Construction and operation of the PV arrays and the placement of associated electrical equipment and cables would be an irretrievable commitment of various resources, such as labor, capital, energy, and land, by the contractor. Use of the land for the PV systems is not an irreversible or irretrievable resource commitment because the systems can be removed at the end of the lease period.

5.3 Relationship between Short-Term Use of the Environment and Long-Term Productivity

NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing one development site reduces future flexibility in pursuing other options, or that using a parcel of land or other resources often eliminates the possibility of other uses at that site.

In the short-term, effects to the human environment with implementation of the Proposed Action would primarily relate to the construction activity itself. Air quality, noise, and transportation would be impacted in the short-term due to temporary construction period effects. In the long-term, the Proposed Action would reduce the amount of fossil fuels used to generate electricity for the Island of Kauai. This would result in beneficial improvements in air quality, reductions in greenhouse gas emissions, and enhanced energy security and stability at PMRF. The construction of the facility and operation would not significantly impact the long-term natural resource productivity of the area. The Proposed Action would not result in any impacts that would significantly reduce environmental productivity or permanently narrow the range of beneficial uses of the environment.

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- This EA was prepared collaboratively between the Navy and contractor preparers.

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Appendix A
Coastal Zone Management Act *de minimis* notification

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Prine, Barbara CIV NAVFAC Pacific, EV

From: Prine, Barbara CIV NAVFAC Pacific, EV <barbara.prine@navy.mil>
Sent: Tuesday, October 04, 2016 1:47 PM
To: 'john.d.nakagawa@hawaii.gov'
Subject: Notification of Proposed PRMF PV EA - as Navy/Marine Minimis Activities under CZMA

Aloha Mr. Nakagawa,

In accordance with General Condition 16, this email to the State CZM office serves as the notification by the Department of the Navy's use of the de minimis list under CZMA for the Photovoltaic and Battery Energy Storage Systems Environmental Assessment (EA) at Pacific Missile Range Facility, Barking Sands, Kauai.

NAVFAC Pacific, on behalf of Pacific Missile Range Facility (PMRF), Kauai, is preparing a Photovoltaic System EA and has determined that the proposed project falls under the de minimis list. The Proposed Action falls within the following items on the list of Navy/Marine Corps De Minimis Activities Under CZMA, Item 1: Construction of new facilities and structures and Item 2: Acquisition, installation, operation, construction, maintenance, or repair of utility or communication systems that uses rights of way, easements, distribution systems, or facilities on Navy/Marine Corps controlled property.

Project information is provided below:

The Draft EA will be issued for a 30-day public comment period starting 28 October 2016. All required consultations and/or coordination with regulatory agencies will be completed prior to the Final EA and anticipated Finding of No Significant Impact.

The Navy proposes to lease up to 181 acres of DoD land to a qualified developer for the construction, operation and decommissioning of a combined utility-scale PV array and BESS on PMRF, Barking Sands near Nohili Road. Solar panels utilize a packaged assembly of solar cells to harness solar energy (photons) from the sun and generate electricity. The panels generate direct current (DC) electricity, which is converted to alternating current (AC) electricity for transmission on the electrical grid and ultimate end-use in AC form.
The solar PV system could generate up to 44 MWdc electrical power and would feed into the KIUC electrical grid for public and military use. The land underlying the PV and BESS facilities would be leased for up to 40 years after which time the lease may be renewed or the facilities may be decommissioned. The Proposed Action could include the installation of up to two transmission lines to connect the proposed PV substations to KIUC's 57 kV transmission line along Kaumualii Highway. One proposed transmission line connection could be located within KIUC's perpetual non-exclusive transmission line easement along Tartar Drive, and the other could be located within a U.S. Coast Guard-owned access Road (Lighthouse Road).

The Proposed Action could be constructed in phases, for example Phase I, Site A [approx. 87 acres] and Phase II, Site B [approx. 94 acres] or developed as one project. Phase 1 would produce up to 21MWdc; Phase 2 would produce up to 23MWdc. The actual generating capacity of the PV system would vary depending on environmental, technical and economic factors.

Please let me know if you have questions.

Thank you,

Barbie Prine
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Prine, Barbara CIV NAVFAC Pacific, EV

From: Nakagawa, John D [mailto:john.d.nakagawa@hawaii.gov]
Sent: Tuesday, October 04, 2016 2:21 PM
To: Prine, Barbara CIV NAVFAC Pacific, EV
Cc: Chang, Connie M CIV NAVFAC PAC
Subject: Notification of Proposed PRMF PV EA - as Navy/Marine Minimis Activities under CZMA

Ms. Prine:

The Navy's notice in accordance with the CZMA De Minimis List General Condition 16, was received on October 4, 2016, and is acknowledged.

John Nakagawa
Hawaii Coastal Zone Management (CZM) Program
Email: john.d.nakagawa@hawaii.gov
Phone: (808) 587-2878

-----Original Message-----
From: Prine, Barbara CIV NAVFAC Pacific, EV [mailto:barbara.prine@navy.mil]
Sent: Tuesday, October 04, 2016 1:47 PM
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The Navy proposes to lease up to 181 acres of DoD land to a qualified developer for the construction, operation and decommissioning of a combined utility-scale PV array and BESS on PMRF, Barking Sands near Nohili Road. Solar panels utilize a packaged assembly of solar cells to harness solar energy (photons) from the sun and generate electricity. The panels generate direct current (DC) electricity, which is converted to alternating current (AC) electricity for transmission on the electrical grid and ultimate end-use in AC form.
The solar PV system could generate up to 44 MWdc electrical power and would feed into the KIUC electrical grid for public and military use. The land underlying the PV and BESS facilities would be leased for up to 40 years after which time the lease may be renewed or the facilities may be decommissioned. The Proposed Action could include the installation of up to two transmission lines to connect the proposed PV substations to KIUC's 57 kV transmission line along Kaumualii Highway. One proposed transmission line connection could be located within KIUC's perpetual non-exclusive transmission line easement along Tartar Drive, and the other could be located within a U.S. Coast Guard-owned access Road (Lighthouse Road).

The Proposed Action could be constructed in phases, for example Phase I, Site A [approx. 87 acres] and Phase II, Site B [approx. 94 acres] or developed as one project. Phase 1 would produce up to 21MWdc; Phase 2 would produce up to 23MWdc. The actual generating capacity of the PV system would vary depending on environmental, technical and economic factors.

Please let me know if you have questions.

Thank you,

Barbie Prine
NEPA Planner (EV21)
Naval Facilities Engineering Command, Pacific
258 Makalapa Drive, Ste 100| JBPHH, HI | 96860-3134
Email: barbara.prine@navy.mil
Direct: 808.472.1385

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Appendix B
Endangered Species Act Section 7 Documentation

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DEPARTMENT OF THE NAVY
PACIFIC MISSILE RANGE FACILITY
P.O. BOX 128
KEKAHA, HAWAII 96752-0128

IN REPLY REFER TO:
5750
Ser EV2/0640
19 DEC 16

Dr. Mary Abrams
Field Supervisor
Pacific Islands Fish and Wildlife Office
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122
Honolulu, HI 96850

SUBJECT: ENDANGERED SPECIES ACT SECTION 7 INFORMAL CONSULTATION FOR PHOTOVOLTAIC AND BATTERY ENERGY STORAGE SYSTEMS AT PACIFIC MISSILE RANGE FACILITY, KAUAI

Dear Dr. Mary Abrams,

Pursuant to the Sikes Act Improvement Amendment (SAIA) and Section 7(a) (2) of the Endangered Species Act (ESA), the Department of the Navy requests informal consultation for the construction and operation of the Photovoltaic and Battery Energy Storage Systems at Pacific Missile Range Facility Kauai, Hawaii. The Navy is proposing to lease 181 acres to construct a utility-scale photovoltaic (PV) array and battery energy storage system (BESS). The Navy intends to improve energy security and reduce the demand for fossil fuels by establishing renewable energy assets on PMRF.

The Navy requests your review and concurrence of the enclosed Biological Evaluation. The Navy has determined our action may affect, but not likely to adversely affect (NLAA) the endangered Hawaiian Hoary bat (Lasiurus cinereus semotus); nocturnal seabirds (Puffinus auricularis (Newell's shearwater), Pterodroma sandwichensis (Hawaiian petrel), and Oceanodroma castroi (Band-rumped storm-petrel); and the Hawaiian goose (Branta sandvicensis) in the course of construction and operation. The point of contact for this consultation is Justin Fujimoto of NAVFAC Pacific. He can be reached at (808) 472-1407 or email at justin.fujimoto@navy.mil.

Sincerely,

L. O. TOTTORI
By Direction

Enclosures: 1. Biological Evaluation
2. Figure 1. Environmental Assessment DOPAA Map
3. Figure 2. USGS Report Map

Biological Evaluation

PHOTOVOLTAIC AND BATTERY ENERGY STORAGE SYSTEMS AT PACIFIC MISSILE RANGE FACILITY, KAUAI

Prepared by:
Naval Facilities Engineering Command

Prepared for:
United States Fish and Wildlife Service
200 Ala Moana Blvd, Room 3-122, box 50088
Honolulu, Hawaii 96850

December 2, 2016

Enclosure (1)

Description of the Proposed Action

The Department of the Navy (DoN) is proposing to lease up to 181 acres of U.S. Department of Defense (DoD) land to a private developer to construct a utility-scale photovoltaic (PV) array and battery energy storage system (BESS) on PMRF. Typically, the PV array will charge the BESS during the day and then the battery will be discharged at night to provide power to the community or larger electrical grid. The BESS may also be used to provide power to the installation during emergent situations when the Kauai Island Utility Cooperative (KIUC) grid supply is not reliable. Two PV and BESS fields will be constructed in the southern section of PMRF occupying 87 acres near the main entrance gate (Site A) and 94 acres at the south end of the base (Site B).

The DoN is the lead agency for the proposed action; PMRF is the action proponent. An Environmental Assessment is being prepared for this project to analyze potential impacts from the proposed action.

Purpose and Need

The proposed project could provide electricity to PMRF in the event of a utility power outage; significantly reduce the daily need to operate costly diesel generators for mission operations; improve current mission and testing capabilities; and demonstrate leadership and successful partnerships by reaching the DoN renewable energy goals. The PV system would provide an alternative source of energy and reduce the dependence on fossil fuels. Operation of the PV system would result in an overall reduction of carbon dioxide emissions and become a net zero energy installation (NZEI).

The purpose of the proposed action is to provide PV and BESS facilities to improve Navy energy security and reduce the demand for energy produced by non-renewable resources by establishing renewable energy generating assets on PMRF. The need for the Proposed Action is to assist the Navy in meeting the Secretary of the Navy's renewable energy goals based on the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007, as well as the National Defense Authorization Act's renewable energy goals.

Location and Project Components

The proposed action would clear 181 acres of kiawe trees (*Prosopis pallida*) and other non-native vegetation for two PV/BESS fields (Figure 1). The action could be constructed in phases, Site A (Phase I, 87 acres) and Site B (Phase II, 94 acres) or developed at one time. Electrical cabling would be used to connect the individual PV modules in raised trays and by overhead cables to the larger electrical system. Electrical connection between Site A and B would be buried underground. Electrical component systems and maintenance buildings would be constructed within the project foot print. The PV site would be contained within an eight-foot-high perimeter fence with no barbed wire. Outdoor lighting could be provided for security purposes; if required, lighting would be on motion sensors, fully shielded and downward facing, utilizing light-emitting diodes and comply with International Dark-Sky Association standards. A

perimeter maintenance road would be located within the fence. Other access roads within the site would consist of gravel or similar base.

A proposed substation located at the project site would allow for power generated and stored to be transferred to the KIUC electrical grid. New electrical transmission lines would be installed overhead to connect the proposed PV substation to the existing KIUC transmission line along Kaumualii Highway. The new transmission lines would service Site A and connect to the KIUC grid along Tarter Drive. Similar transmission lines would be needed for Site B and connect to the utility grid along Lighthouse Road. The plan is to replace the existing utility poles and place the two voltages, 57 kV line above the 12.4kV line, on one new pole. The new transmission lines would be 50 feet high and stretch approximately 875 feet to the KIUC transmission line along Tarter Drive. The second electrical line and poles would stretch 1,796 feet to the KIUC transmission line along Lighthouse Road. Both stretches of transmission lines will have two levels of wires, 57 kV at the top level and the 12.4 kV at the lower level supported by T-cross bars.

Description of the Action Area

Vegetation at the proposed project site consists of tall kiawe trees (*Prosopis pallida*), a mid-canopy of koa haole (*Leucaena leucocephala*), some aalii (*Dodoea viscosa*), and groundcover of buffel grass (*Cenchrus ciliaris*). The kiawe trees are between 30 and 40 feet high, forming a dense upper canopy. Other plants found in the forested area include *Pluchea carolinensis*, *Ocimum gratissimum*, *Waltheria indica*, and *Scaevola taccada*. One patch of native aalii-nama scrub vegetation was located in the south section of Site B. This site was surveyed and no endangered plants were found.

Species Addressed in this Biological Evaluation

Section 7(a)(2) of the Endangered Species Act (ESA) states, "Each Federal agency shall, in consultation with and with the assistance of the Secretary of the Interior, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species." To "jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species [50 CFR §402.02].

The endangered species that are known within the action area and covered in the scope of this BE are listed below:

Common Name	Scientific Name	ESA Status	Affects Determination
Hawaiian hoary bat	*Lasiurus cinereus semotus*	Endangered	Not Likely to Adversely Affect
Hawaiian goose	*Branta sandvicensis*	Endangered	Not Likely to Adversely

3 Enclosure (1)

			Affect
Hawaiian petrel	*Pterodroma sandwichensis*	Endangered	Not Likely to Adversely Affect
Band-rumped storm-petrel	*Oceanodroma castroi*	Endangered	Not Likely to Adversely Affect
Newell's shearwater	*Puffinus auricularis*	Threatened	Not Likely to Adversely Affect

Our determination of "not likely to adversely affect" was based on our effects determination that the proposed action is insignificant and the effects will not reach the scale in which take would occur.

Species Eliminated From Detailed Analysis

There are other listed endangered species on PMRF that have been considered as part of this BE, but not further addressed because there will be no impact by the proposed action. The impact analysis to these species has been done through field surveys, habitat analysis, and historical survey reports. The following species are eliminated from further detailed analysis: lau ehu (*Panicum niihauensis*), Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian Coot (Fulica alai), and Hawaiian Moorhen (*Gallinula chloropus sandvicensis*)

Endangered Species Description

Hawaiian hoary bat (*Lasiurus cinereus semotus*)

The Hawaiian hoary bat was listed as endangered on October 13, 1970 (USFWS 1998). Critical habitat for this species has not been designated. The Hawaiian hoary bat is a solitary species that has been recorded on Kauai, Oahu, Maui and Hawaii Island, with the largest populations on Kauai and Hawaii Island (USFWS 1998). Population estimates for all islands have ranged from hundreds to a few thousands (USFWS 1998). The USFWS Recovery Plan points out that estimates have not been based on systematic surveys and although these estimates may represent informed impressions, they are based on limited and incomplete data. Overall, few historic or present distribution records exist, limiting the ability to infer historic or present distribution numbers (USFWS 1998). The decline of the species has been attributed to loss of tree cover in historical habitats and the use of pesticides. Most observations of bats have been made between sea level and 2,286 meters in elevation, but their presence has been documented at up to 4,023 m in elevation (Gon et al. 1993).

The hoary bat uses a wide variety of habitat including native, non-native, and agricultural areas. Vegetation cover and structure appear to be more important than a particular vegetation species. Hoary bats were more present in mature forest cover that provided abundant prey and shade for day roosting (Gorresen et al. 2015). As an example, hoary bats use eucalyptus, albizia, macadamia, ohia, koa, and mamane-naio forest for foraging and roosting. Rangelands near forest edges, rural yards, agriculture windbreaks, and croplands could also be used (Koob 2012). Overall, transition areas or forest breaks are good bat areas. On Kauai, Hoary Bats have been

detected at ocean outlets and forested rivers. At night, bats forage on native and non-native insects such as moths, beetles, termites, leafhoppers, and flies (USFWS 1998).

Lowland occurrences of the Hoary Bat have been documented at PMRF. A study by USGS Pacific Island Ecosystem Research Center at PMRF documented the presence of hoary bats at the location of the proposed PV facility (Bonaccorso 2011). Similarly, bats have been detected at all parts of the installation. During this study an ultrasound recorder was positioned at the edge of the THADD radar facility fence (Station 300), this location is between the two proposed PV sites (Figure 2). Bats were detected every night during the survey period from September 9, 2010 to December 6, 2010 (Bonaccorso 2011). A total of four bat recorders were positioned in the south part of the base to provide regional information about bat use at PMRF. The two other regions, the north covering Makaha Ridge, and west covering the Nohili were compared to the south bat detections. Foraging events were detected most often during September – October 2010 for all regions but there were periods of no feeding events in the southern area. Fall swarming, or the period when bats congregate to mate was detected in the northern section of the base. No swarming was detected in the south.

Hawaiian Goose (*Branta sandvicensis*)
The Hawaiian goose, or Nene, is endemic to the Main Hawaiian Islands, and while the species once occurred throughout the archipelago, it is now restricted to the islands of Hawaii, Maui, and Kauai (Banko et al. 1999). Following substantial declines in lowland populations due to over-hunting, the species was federally listed as endangered in 1967 (http://ecos.fws.gov/speciesProfile/ profile/speciesProfile.action?spcode=B00C).

The largest population of Hawaiian geese occurs on the island of Hawaii at Hawaii Volcanoes National Park. The population on Maui is concentrated at Haleakala National Park (Banko et al. 1999). On Kauai, the largest breeding populations occur at Kilauea Point National Wildlife Refuge, Kipu Kai (between the towns of Lihue and Poipu), and upland along the Na Pali Coast (Banko et al. 1999). Eggs can be laid during all moths except May, June and July, with the peak nesting season occurring during the rainy season between October and March. With a 30-day incubation period, most eggs hatch between October and December, and goslings remain with their parents until the beginning of the next breeding season (Banko et al. 1999). In 2005, total goose numbers were estimated to be approximately 1,400, with 700 individuals on Kauai (Hawaii DLNR 2005a). Hawaiian goose populations are thought to be limited by habitat availability in upland areas and by predators in the lowlands (Banko et al. 1999).

Over the past three years, numbers of Hawaiian geese at PMRF have increased in conjunction with an effort by the State of Hawaii to translocate geese from Lihue Airport to Kokee State Park (Commander Navy Region Hawaii 2010). Up to 20 Hawaiian geese have been observed at a time at Barking Sands, primarily near the Beach Cottages, HIANG (U.S. Army and Hawaii Air National Guard) complex, and southern portion of the airfield, adjacent to Kinikini Ditch and the

Kawaiele Wetlands that occur outside of the base to the east. Because Hawaiian geese are large-bodied birds they are a Bird Airstrike Hazard (BASH). The Navy hazes Hawaiian geese from the flight area to reduce this risk. The Navy also deters goose nesting on PMRF to prevent young from returning to its place of birth due to site fidelity. During the 2011 breeding season, PMRF personnel observed five pairs of Hawaiian geese that exhibited nesting behavior. The focus of hazing for that period was on these birds to deter them from breeding on the base (USFWS 2014)

From 2009 to 2011 a total of four Hawaiian goose nests have been documented within the southern portion of the base from the HIANG complex to the oxidation ponds. In 2009, one nest was detected near the HIANG administrative office and was successfully transported to the Kilauea Point NWR. In January 2011, another nest was found in the HIANG complex, but failed during incubation. Two nests were documented in December 2011, one in the HIANG complex and one in the sewage oxidation pond fence. Both nests successfully hatched and fledged offspring. During the 2012-2013 nesting season three nests were found. From October 2015 to October 2016 five successful nests hatched. One nest was found south of the runway, one nest was at the HIANG site, and four nests were found at the oxidation pond (NAVFAC Hawaii personal Com 2016).

Nocturnal Seabirds: Hawaiian petrel (*Pterodroma sandwichensis*), Band-rumped storm-petrel (*Oceanodroma castroi*), and Newell's Shearwater (*Puffinus auricularis*)
The Hawaiian petrel was federally listed as endangered in 1967 (Simons and Hodges 1998). Populations of the Hawaiian petrel nest on the islands of Hawaii, Maui, Lanai, and Kauai, and they may also nest on Molokai, Lehua and the seastacks off of Kahoolawe (Simons and Hodges 1998, Hawaii DNLR 2005b). The largest Hawaiian petrel breeding colonies occur on Kauai (Cooper and Day 1998, Hawaii Department of Land and Natural Resources 2005), where the birds are thought to excavate burrows under dense vegetation along headwalls of interior valleys (Simons and Hodges 1998). On Kauai, eggs are laid from May through June, and most young birds fledge by December (Hawaii Department of Land and Natural Resources 2005). In 1995, the total population size of Hawaiian petrels was estimated to be 19,000 (Spear et al. 1995). The greatest threat to the Hawaiian petrel is predation by non-native avian and mammalian predators, including barn owls (*Tyto alba*), cats, and rats (U.S. Fish and Wildlife Service 1983).

The band-rumped storm-petrel occurs throughout the Pacific and Atlantic oceans, breeding in Japan, the Galapagos Islands, Hawaii, and eastern Atlantic islands off of the coasts of Europe and Africa. While not considered to be threatened across its global range, the band-rumped storm-petrel was listed as endangered under the ESA on October 31, 2016 (Federal Register 2016). In Hawaii, band-rumped storm-petrels are known to nest on Kauai and are thought to nest on the islands of Hawaii and Maui. The known breeding colony on Kauai is restricted to steep cliffs dominated by native plant species. Although population size has not been well-quantified for this species in Hawaii, there are thought to be more than 100 breeding pairs on Kauai

(Slotterback 2002). The species is thought to begin nesting in April in Hawaii, with juveniles fledging from the nests in October (Slotterback 2002). Ingested contaminants and plastics, degradation of nesting and foraging habitats, and collisions with structures are considered to be the greatest threats to band-rumped storm-petrel populations (Slotterback 2002).

The Newell's shearwater is endemic to the main Hawaiian Islands (Ainley et al. 1997). The subspecies was federally listed as threatened in 1975. As with the Hawaiian petrel, the largest breeding colonies of Newell's shearwaters occur on Kauai, with nesting also occurring on Molokai and Hawaii (Ainley et al. 1997). Newell's shearwaters nest in burrows or deep rock crevices at elevations from 525 to 4000 ft. Due to predation pressure by introduced mammals, nesting is now restricted to slopes that exceed a 65° angle (Ainley et al. 1997). The breeding season for Newell's shearwaters is estimated to be April through November. On Kauai, eggs are laid during the first two weeks of June, and fledglings leave the burrows in October (Telfer et al. 1987). In 1995, the total population size of Newell's shearwaters was estimated to be 84,000 (Spear et al. 1995). As with Hawaiian petrels, the greatest threats to Newell's shearwater populations are non-native predators, including barn owls (*Tyto alba*), cats, and rats (U.S. Fish and Wildlife Service 1983, Ainley et al. 1997, Ainley et al. 2001).

Potential Effects from the Action

Hawaiian Hoary Bay (*Lasiurus cinereus semotus*)

The proposed construction project would clear the 181 acres of kiawe trees and other non-native vegetation, which is a potential roosting and pupping site for hoary bats. Since hoary bats utilize a wide range of vegetation and habitat types for roosting, it is assumed they could easily find other roosting sites in the adjacent area or other areas throughout the base if displaced by vegetation clearing. Young bats could also use this area during the pupping and fledging season (1 June through 15 September). During this time when young bats are not able to fly, they would not be able to escape if vegetation clearing occurred.

Hawaiian Goose (*Branta sandvicensis*)

The proposed project would clear the 181 acres of kiawe trees and other non-native vegetation, which is a potential nesting habitat for the Hawaiian goose from August to April. The Navy conducts hazing around the air field to prevent BASH. Hazing will be used in and around the construction site to prevent any birds from being harmed. Hazing will force Hawaiian geese to move off base to adjacent properties on sub-optimal habitat on the Mana Plain. Additionally, the Hawaiian goose uses adjacent areas near the project site for loafing and foraging. Birds that are hazed could use adequate habitat in western Kauai and the surrounding Mana area. It is anticipated that hazing is a temporary action, and forcing Hawaiian geese to move to other habitats will not cause any reduction in fitness or survivorship (USFWS 2014).

Nocturnal Seabirds (*Puffinus auricularis*, *Pterodroma sandwichensis*, *Oceanodroma castro*)

Construction of the utility poles that connect the PV system to the KIUC transmission lines could cause a collision hazard for nocturnal seabirds. The utility poles will have two levels of transmission lines to support the 57 kV line above the 12.4kV line. Nocturnal seabirds have the potential to collide into tall structures in their flight path from the ocean to roosting sites at higher elevations. Although the lines will be placed on existing poles the addition of more lines increase the chances for seabirds to collide with the wires. Nocturnal seabird collision with communication tower or utility lines has not been observed at PMRF (DoN 2013). In 2008, a survey for dead birds was conducted under all communication towers at Barking Sands. No dead seabirds were found during the period from mid-October to mid-December 2008 (DoN 2013).

Newell's shearwaters, Hawaiian petrels, and band-rumped storm-petrels only nest at high elevations on Kauai. Because Barking Sands is located along the coastline of Kauai, there is no potential for these species to nest at the proposed PV site. Individuals of these species do commute between inland breeding colonies and at-sea foraging areas, making all of the PMRF sites potential areas for nocturnal seabird over-flights. The period of October through December is particularly critical for these species in terms of over-flights, as fledglings leave the inland nests for their first trips to sea (Ainley et al. 1997, Simons and Hodges 1998).

Critical Habitat

No protected habitat for endangered species exists within the proposed PV and BESS site. Critical habitat for the Hawaiian hoary bat, Hawaiian goose, and nocturnal seabirds has not been designated. Critical habitat for the endangered grass lau ehu (*Panicum niihauensis*) is designated along the northern and southern beach of the installation. However, the project site does not lie within the designated critical habitat.

Conservation Measures

The following best management practices (BMPs) will be the responsibility of the private developer who will construct and operate the PV and BESS systems. The developer will submit notices of planned actions and reports of conservation measures taken to the Navy for approval and review. The BMPs are as follows:

1. To avoid take of hoary bats, construction activities to clear tree vegetation would not take place during the bat pupping and fledging season from 1 June through 30 September.

2. If any bat pups are discovered in the construction zone, outside the normal nesting season, vegetation clearing must stop and move 100 yards away. Construction cannot resume until the bat pups have fledged and departed the area.

In the event that a Hawaiian goose is found during the construction of the PV and BESS system the following will be instituted:

1. To avoid nesting disturbances, construction of the PV and BESS system would be scheduled to avoid the Hawaiian goose nesting season from August to April. If construction needs to occur

during the nesting season, hazing will be conducted to prevent geese from nesting or loafing in the construction site. Hazing will be conducted before and during the nesting season to deter geese from settling on the site. The developer would be responsible for ensuring that a qualified biologist approved by the Navy conducts any hazing activities.

2. If a Hawaiian goose is observed within the PV site, or if a Hawaiian goose flies into the site while activities are occurring, all activities would halt within 100 feet of the bird(s). Work would not resume until the bird(s) have left the area of their own accord.

3. In the unlikely event that a nest is found during construction despite hazing, a 100-foot buffer would be established around active nests and broods until the goslings have fledged. Potential disturbing activities (i.e. construction or noisy equipment use) would not be conducted within this buffer.

Because nocturnal seabirds (*Puffinus auricularis*, *Pterodroma sandwichensis*, *Oceanodroma castro*) have the potential to collide with tall structures such as the utility line poles, surveys for downed seabirds will occur under the utility lines. The developer will be responsible for providing a qualified biologist to search the area under the utility lines for any downed birds that may collide with the structures. The searches will be conducted for one year after the utility lines have been constructed to assess the rates of nocturnal seabird strikes. Results of the monitoring efforts will be reported during the yearly reporting meeting with the FWS. The biologist will be approved by the Navy and will follow carcass search protocols provided in the 2014 Base-wide Biological Opinion (FWS 2014).

Conclusion

Hawaiian Hoary Bat

The Department of the Navy has determined that the proposed action may affect, but is not likely to adversely affect (NLAA), the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). DoN requests USFWS concurrence with this NLAA determination. Conservation measures will be followed to prevent take of bats that are unable to flee during vegetation removal.

Nocturnal seabirds

The DoN has determined that the proposed action may effect, but not likely to adversely affect (NLAA) nocturnal seabirds (*Puffinus auricularis*, *Pterodroma sandwichensis*, *Oceanodroma castro*). In the unlikely event that a nocturnal seabird would strike the utility lines or poles, it would be collected by monitoring efforts but would not affect the continued to existence of the species. DoN requests USFWS concurrence with this NLAA determination.

Hawaiian Goose

The DoN has determined that the proposed action may effect, but not likely to adversely affect (NLAA) the Hawaiian goose. PMRF currently conducts hazing by trained wildlife biologists to prevent nesting and loafing of Hawaiian geese under a base wide Biological Opinion. In the unlikely event that a Hawaiian goose is within the project site during construction, conservations measures will be enacted to protect Hawaiian geese from harm, harassment, or take. DoN requests USFWS concurrence with this NLAA determination.

Enclosure
Figure 1: PMRF PV Site Map
Figure 2: Map of Bat Detector Stations

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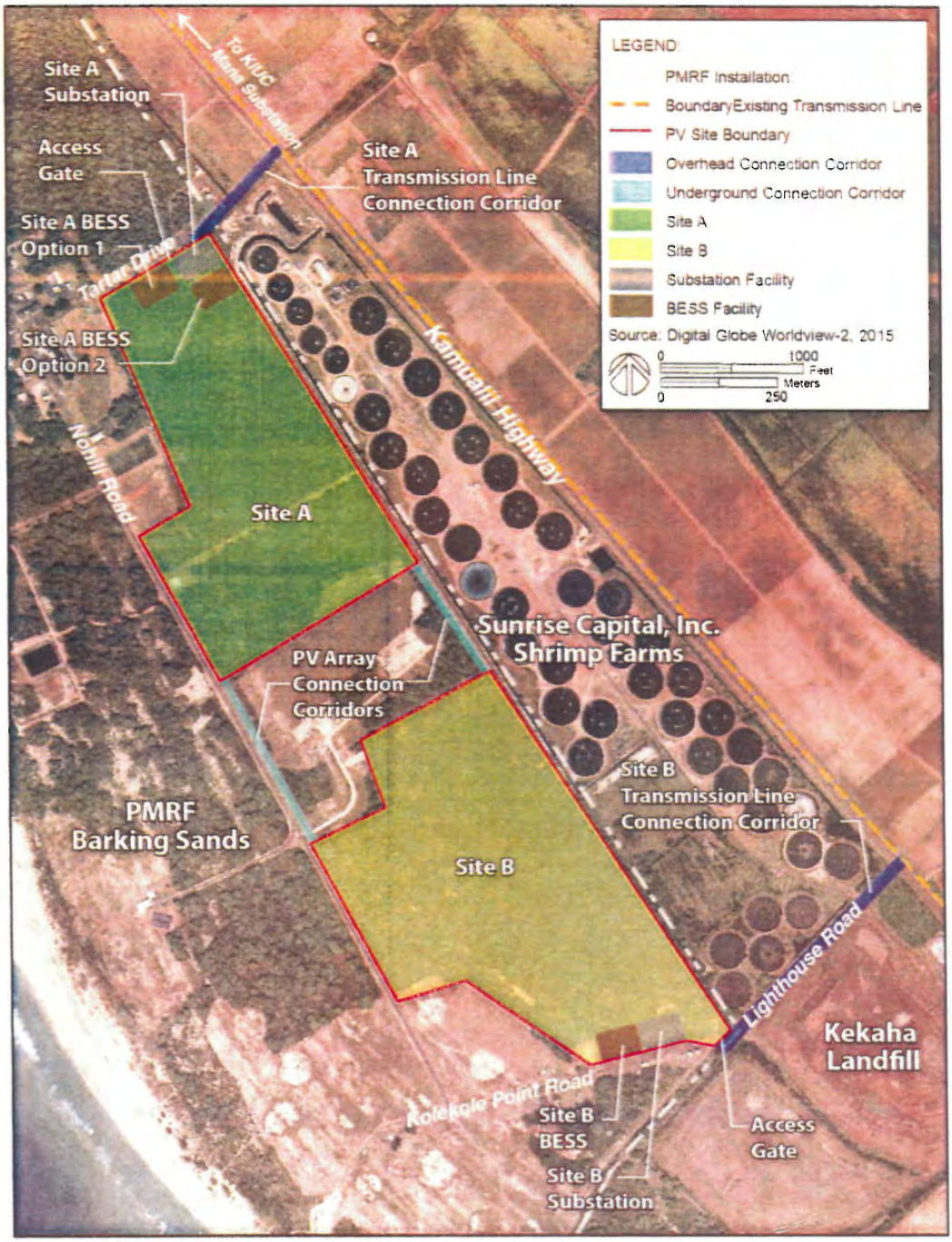

Figure 1 PMRF PV Site Map

Enclosure (2)

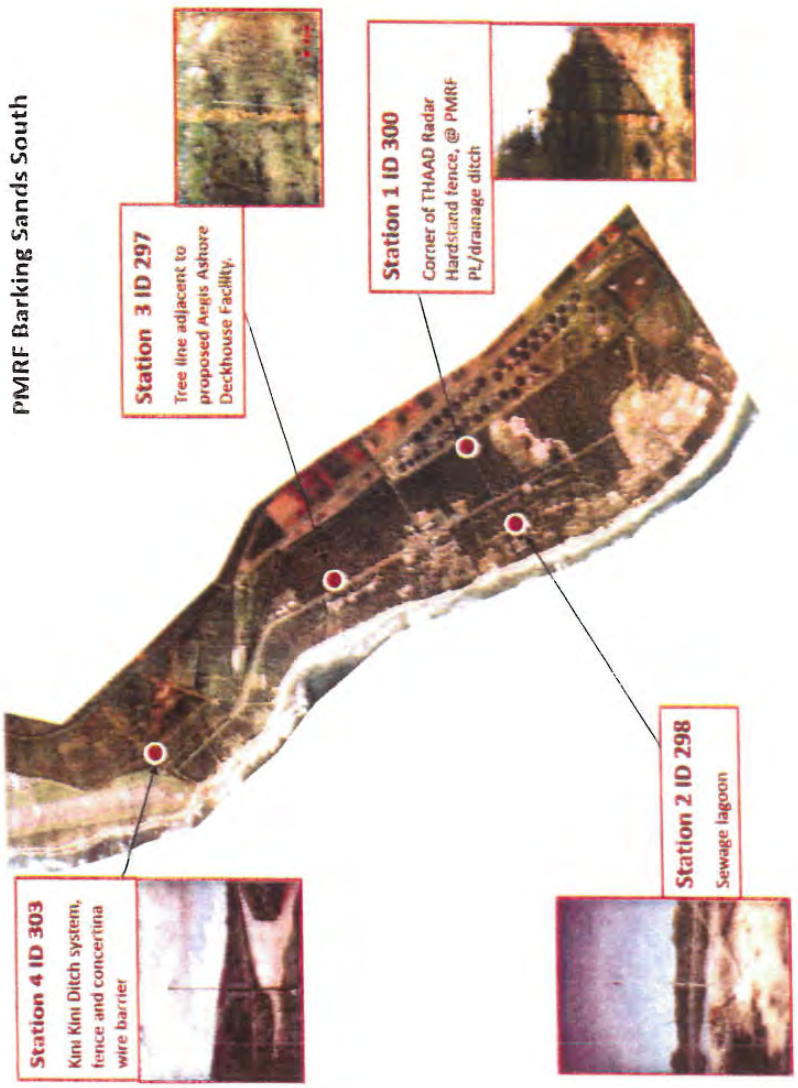

Figure 2. Map of point stations 1 through 4 (red dots) for the southern region of PMRF (South).

Enclosure (3)

Appendix C
National Historic Preservation Act Section 106 Documentation

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DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND, PACIFIC
258 MAKALAPA DR., STE. 100
JBPHH HI 96860-3134

5750
Ser EV2/00505
October 28, 2016

Dr. Alan Downer
Deputy State Historic Preservation Officer
State Historic Preservation Division
Kakuhihewa Building
601 Kamokila Boulevard, Suite 555
Kapolei, Hawaii 96707

Dear Dr. Downer:

Subj: SECTION 106 CONSULTATION FOR PROPOSED PROJECT TO CONSTRUCT AND OPERATE PHOTOVOLTAIC AND BATTERY ENERGY STORAGE SYSTEMS AT PACIFIC MISSILE RANGE FACILITY, KAUAI, HAWAII

Pursuant to Section 106 of the National Historic Preservation Act (NHPA), Commander Navy Region Hawaii (CNRH) requests your review of the proposed construction and operation of a utility scale photovoltaic system (PV) and battery energy storage system (BESS) at the Pacific Missile Range Facility (PMRF), Kauai (enclosures 1 and 2). In accordance with the implementing regulations of Section 106 of the NHPA, we reviewed the proposed project and determined that it is an undertaking as defined by 36 CFR 800.16 (y).

PROJECT DESCRIPTION

The proposed project to construct a combined utility-scale photovoltaic (PV) array and battery energy storage system (BESS) would improve the Navy's energy security and increase the supply for energy produced from-renewable resources by enabling the development of renewable energy generating assets on PMRF. The new facility would generate power for both military and public use. This project is to assist the Department of the Navy in meeting the Secretary of the Navy's renewable energy goals based on the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007, as well as the National Defense Authorization Act's renewable energy goals.

The project would construct new facilities and replace power poles. Construction would include excavation to install the PV panels, concrete equipment slabs, and subsurface utility lines; and construction of support buildings and structures.

Replacement of existing power poles would be required to support 57 kV overhead lines. The solar PV system would feed into the Kauai Island Utility Cooperative (KIUC) transmission line along Kaumualii Highway using one of two proposed connection routes: Tartar Drive or Lighthouse Road. While both currently support 12.47 kilovolt (kV) overhead electrical distribution lines, new power poles are needed for the 57 kV overhead lines. Both routes extend beyond the PMRF installation boundary on to state land.

AREA OF POTENTIAL EFFECT

The area of potential effect (APE) includes two separate locations, Project Site A and Site B, on the PMRF installation, along Nohili/South Sidewinder Road; and one of two utility corridors that extend onto state land (enclosure 2). Site A is approximately 87 acres with Site B being 94 acres. Up to two transmission lines may be installed, along Tartar Drive and/or Lighthouse Road, to connect to the PV substations and KIUC's transmission line along Kaumualii Highway. The APE took into consideration multiple variables that have the potential to affect historic properties including the direct effects from construction, as well as visual and auditory effects.

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IDENTIFICATION OF HISTORIC PROPERTIES

There are no known archaeological resources identified within either of the two locations on PMRF. Both locations are within areas that have been determined to have low potential for archaeological resources (SEARCH 2012). Archaeological studies conducted by Wulzen et al (1997), Walker and Rosendahl (1990), NAVFAC Pacific (PACDIV 2002), and Clark et al (2015) have documented previous disturbance and found no archaeological resources (enclosure 3).

The two proposed access corridors extend to land owned by the State of Hawai'i that was previously studied by Masterson et al. (1994). They were found to have no archaeological resources or cultural deposits present. All proposed activities along these sections would be to upgrade/replace the current utility lines and power poles and would therefore take place in areas of previous disturbance.

Three historic landscape features are located within or adjacent to the proposed project sites. The PMRF Cultural Landscape Report (TEC Inc.-Joint Venture and NAVFAC Pacific 2011) identifies Nohili Road, Tartar Drive, and the House Area Gate on Tartar Drive as both contributing and character defining features within the PMRF historic landscape as seen on enclosure (4). A list of references is provided in enclosure (5). As contributing features within the landscape, these three circulation features have been identified as contributing to the integrity of the PMRF historic landscape and serve to define its character. The proposed project would not affect the character defining features of the roads or the gate.

DETERMINATION OF EFFECT

In consideration of the above information, the Navy has determined that the proposed project would have *"no adverse effect"* on historic properties. In the unlikely event that NAGPRA cultural items are discovered, all construction activities will stop and the remains will be stabilized and protected. Treatment will proceed under the authority of NAGPRA.

We request your review and concurrence with our determination of effect within 30 days of receipt of this letter. In accordance with 36 CFR 800.5(c), we will assume your concurrence if no objection is received from your office within 30 days of your receipt of this letter. Should you have any questions regarding this undertaking, please contact Mr. Jeffrey Fong, Archaeologist, Naval Facilities Engineering Command, Pacific, at (808) 472-1383, or via email at jeffrey.fong@navy.mil.

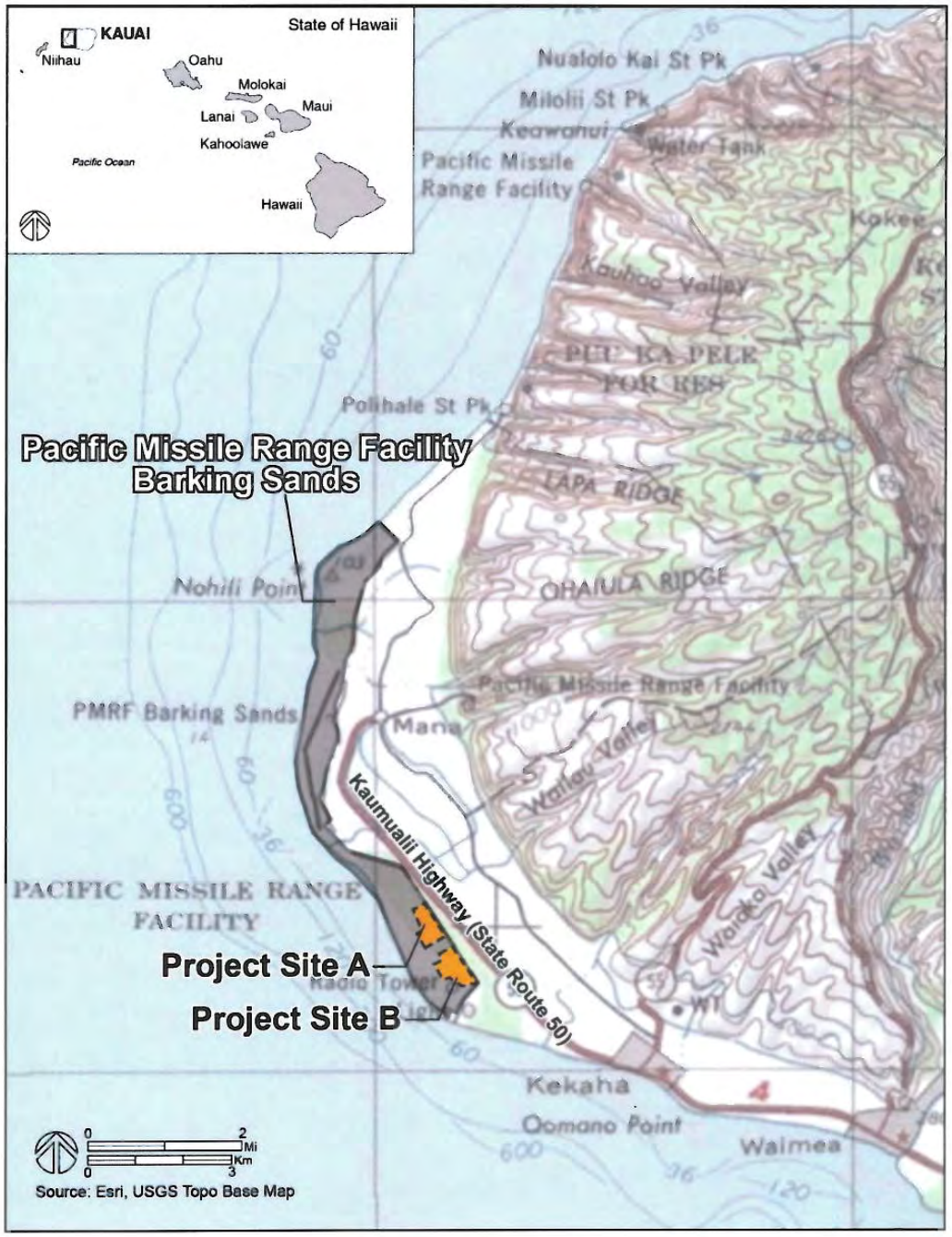
Sincerely,

KAREN C. SUMIDA
By direction

Enclosures: 1. Project Location Map
2. Site Map of Proposed Project Areas
3. USGS Map of PMRF with APE
4. PMRF Cultural Landscape Report Map
5. List of References

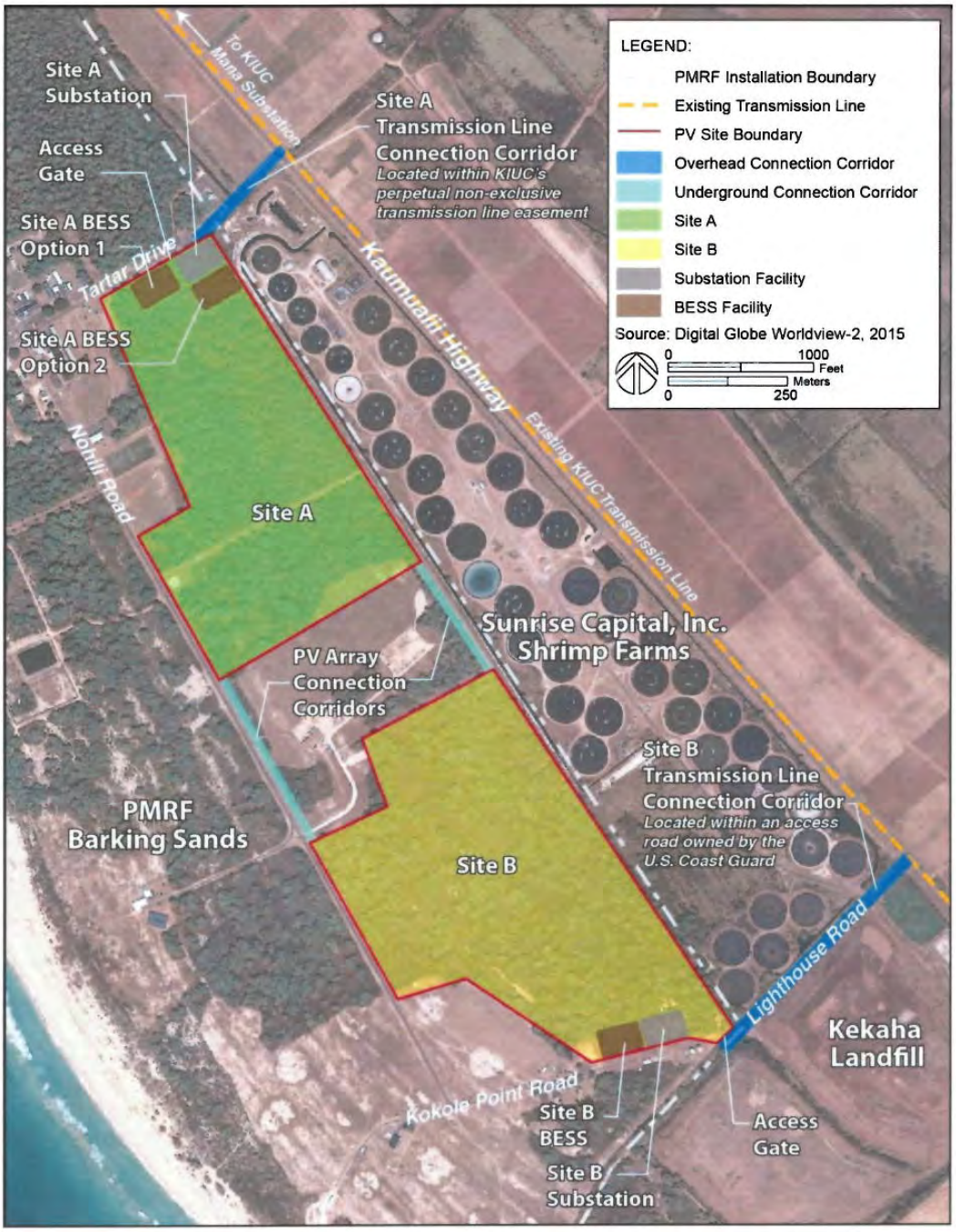
2

PROJECT LOCATION MAP



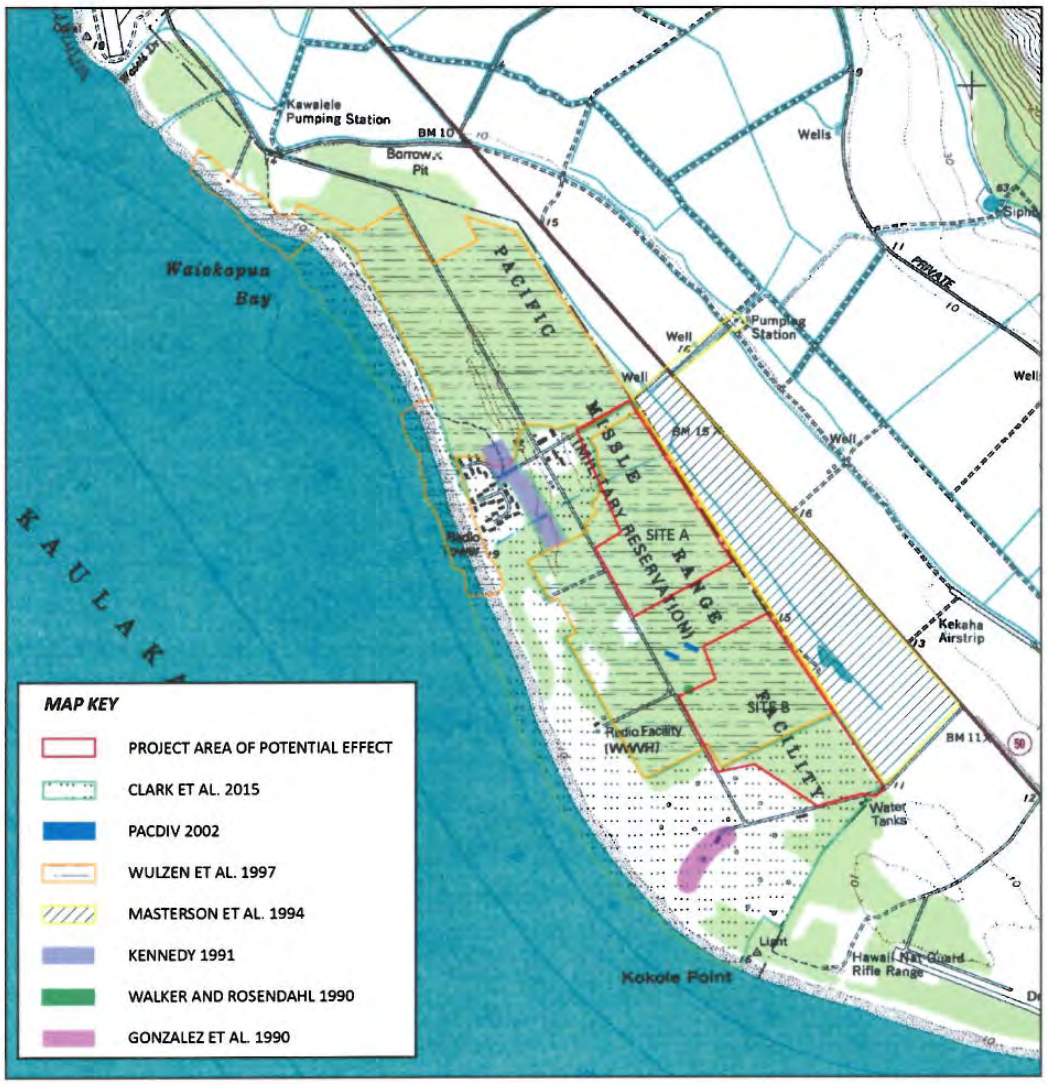
Enclosure (1)

SITE MAP OF PROPOSED PROJECT AREAS



Enclosure (2)

USGS MAP OF PMRF WITH APE



Portion of USGS topographic map Kekaha Quadrangle showing locations of previous archaeological studies within the vicinity of the proposed project's APE on the south end of PMRF.

Enclosure (3)

PMRF CULTURAL LANDSCAPE REPORT MAP

Map from PMRF Cultural Landscape Report showing character-defining features within vicinity of the proposed project's APE on the south end of PMRF.

Enclosure (4)

LIST OF REFERENCES

Clark, Stephan D., Dennis C. Gosser, Keola Nakamura, and Richard Nees. 2015. *Final Report: Archaeological Survey and Testing in the Southern Portion of Pacific Missile Range Facility. Barking Sands, Kaua'i, Hawai'i. TMK: (4) 1-2-002:013.* Prepared for Department of the Navy, Naval Facilities Engineering Command, Pacific. Pacific Consulting Services, Inc, Honolulu, Hawai'i.

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Pacific Division, Naval Facilities Engineering Command. 2002. *Archaeological Investigation in support of BMDO 463 Launch Facilities Project and BMDO 464 THADD Test Facilities at Pacific Missile Range Facility (PMRF), Kauai, Hawaii.* Prepared for Pacific Division, Naval Facilities Engineering Command, Engineer Program Group – Design Program Management. Pacific Division, Naval Facilities Engineering Command, Environmental Planning Division, Cultural Resources Branch, Pearl Harbor, Hawai'i.

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Enclosure (5)

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DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND, PACIFIC
258 MAKALAPA DR., STE. 100
JBPHH HI 96860-3134

5750
Ser EV2/00518
November 10, 2016

Dr. Kamana'opono M. Crabbe
Ka Pouhana, Chief Executive Officer
State of Hawai'i
Office of Hawaiian Affairs
711 Kapi'olani Boulevard, Room 555
Honolulu, Hawaii 96813

Dear Dr. Crabbe:

Subj: SECTION 106 CONSULTATION FOR PROPOSED PROJECT TO CONSTRUCT AND OPERATE PHOTOVOLTAIC AND BATTERY ENERGY STORAGE SYSTEMS AT PACIFIC MISSILE RANGE FACILITY, KAUAI, HAWAII

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Sincerely,

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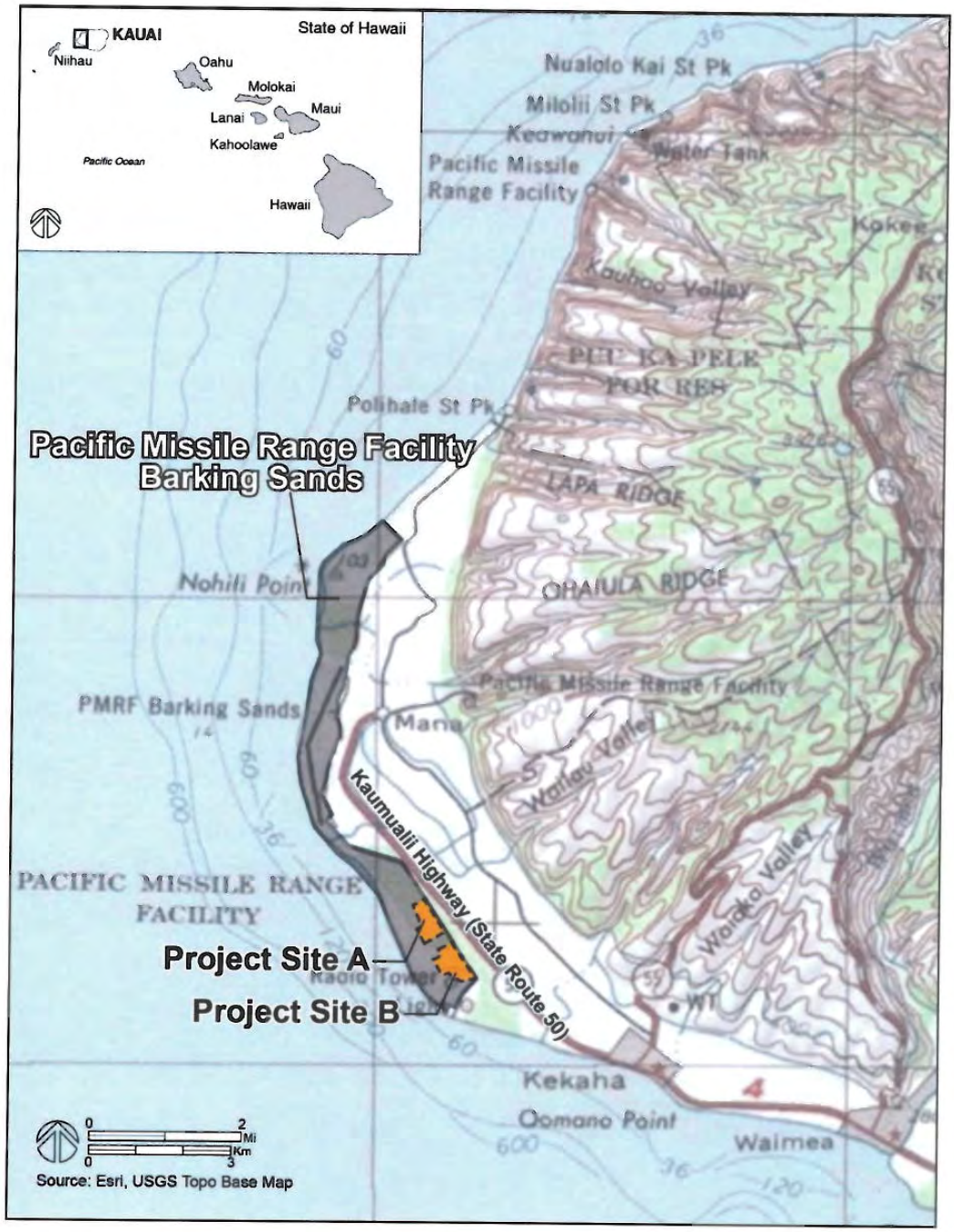
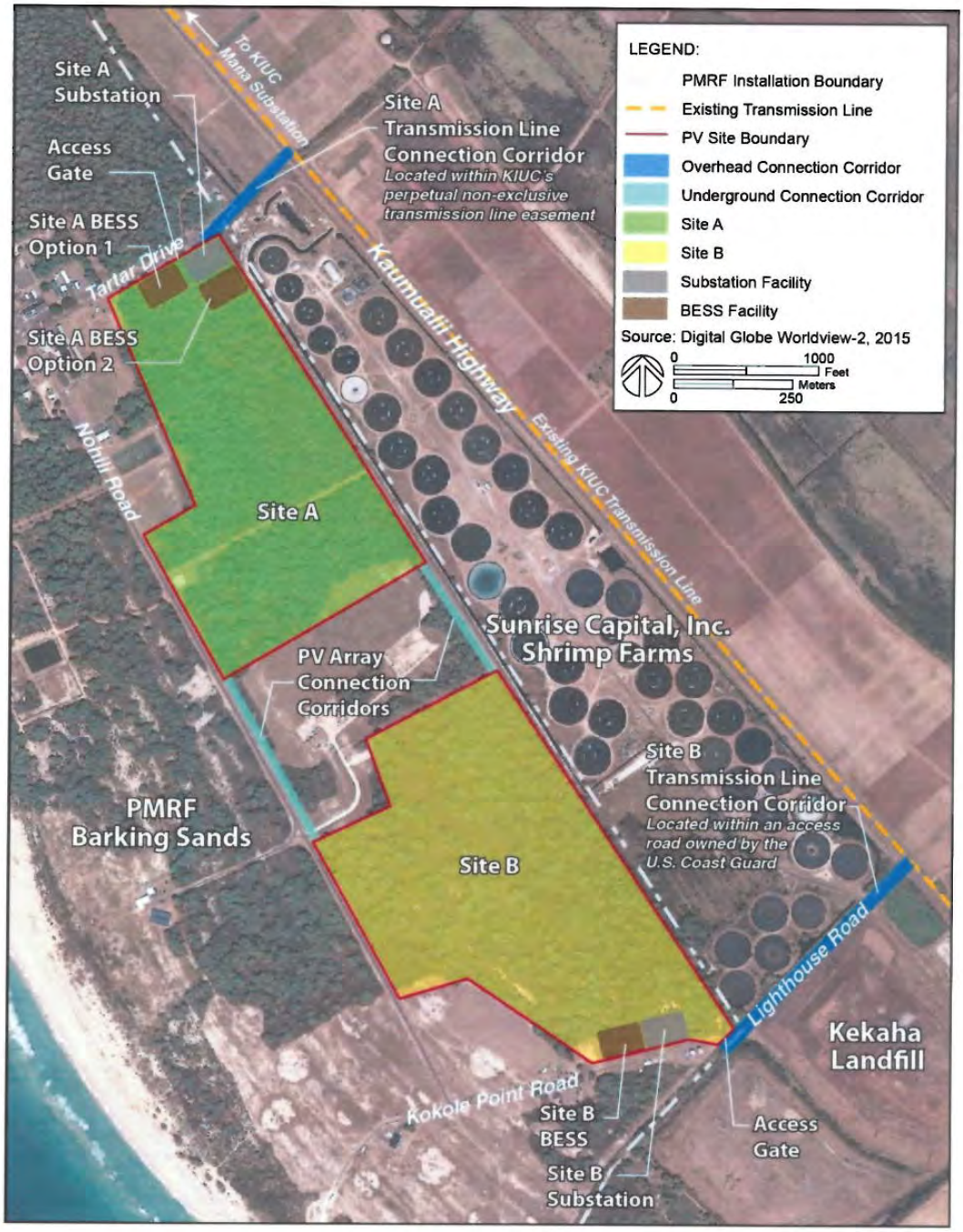
PROJECT LOCATION MAP



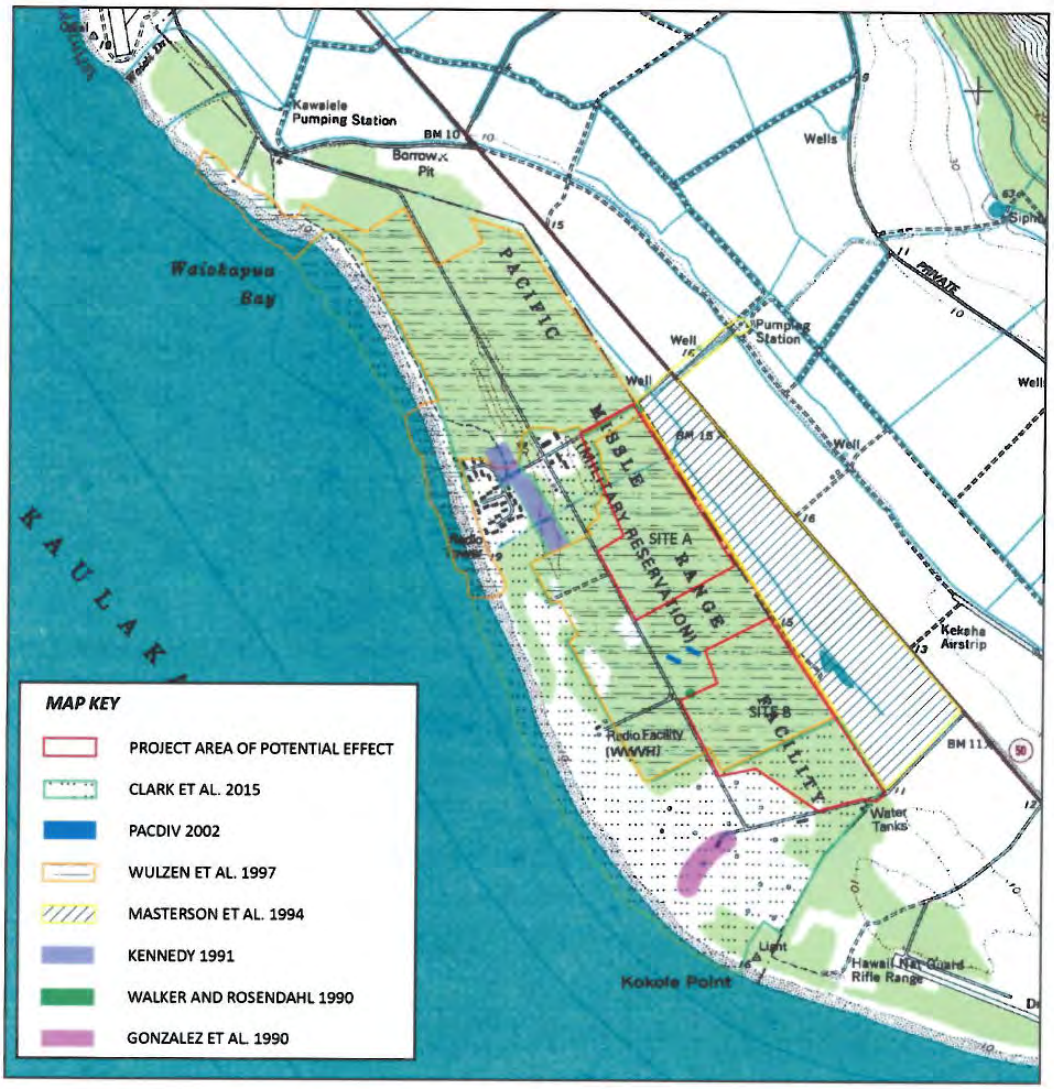
Enclosure (1)

SITE MAP OF PROPOSED PROJECT AREAS



Enclosure (2)

USGS MAP OF PMRF WITH APE



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Enclosure (5)

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Appendix D
Glint and Glare Analysis

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ForgeSolar (/)
PV planning & glare analysis

Site config: Site A Runway 16 Fixed

No site config description provided.

Created **Sept. 8, 2016 12:47 a.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results No glare predicted!

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
Site A	20.0	180.0	0	0	0	-

Component Data

Flight Paths

Name: FP 1
Description:
Threshold height: 50 ft
Direction: 350.4 deg
Glide slope: 3.0 deg
Pilot view restricted? No

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	22.030850	-159.786583	19	50	69
2-mile point	22.059357	-159.791791	-46	669	622

Observation Points

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1	22.031231	-159.783453	14	60	74

Site A

Axis tracking: Fixed (no rotation)
Tilt: 20.0 deg
Orientation: 180.0 deg
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Tota elevat
	deg	deg	ft	ft	ft
1	21.994629	-159.757369	14	0	14
2	21.992441	-159.761424	16	0	16
3	21.994987	-159.762990	18	0	18
4	21.995485	-159.762111	17	0	17
5	21.999603	-159.763570	19	0	19
6	22.000180	-159.762561	17	0	17
7	21.999762	-159.762325	17	0	17
8	22.000339	-159.761188	15	0	15

No glare predicted!

ForgeSolar (/)
PV planning & glare analysis

Site config: Site A Runway 16 Tracking

No site config description provided.

Created **Sept. 8, 2016 12:35 a.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results No glare predicted!

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
Site A	0.0	180.0	0	0	0	-

Component Data

Flight Paths

Name: FP 1
Description:
Threshold height: 50 ft
Direction: 350.4 deg
Glide slope: 3.0 deg
Pilot view restricted? No

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	22.030850	-159.786583	19	50	69
2-mile point	22.059357	-159.791791	-46	669	622

Observation Points

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1	22.031231	-159.783453	14	60	74

Site A

Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Limit tracking rotation? No
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Tota elevat
	deg	deg	ft	ft	ft
1	21.994629	-159.757369	14	0	14
2	21.992441	-159.761424	16	0	16
3	21.994987	-159.762990	18	0	18
4	21.995485	-159.762111	17	0	17
5	21.999603	-159.763570	19	0	19
6	22.000180	-159.762561	17	0	17
7	21.999762	-159.762325	17	0	17
8	22.000339	-159.761188	15	0	15

No glare predicted!

ForgeSolar (/)
PV planning & glare analysis

Site config: way 34 oval fixsite a runed

No site config description provided.

Created **Sept. 8, 2016 12:17 a.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results Glare with potential for temporary after-image predicted

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
Site A	20.0	180.0	1866	1248	0	-

Component Data

Observation Points

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1	22.031231	-159.783453	14	60	74
2	22.015097	-159.783595	10	66	76
3	21.998814	-159.780464	0	316	316
4	21.988214	-159.789742	0	466	466
5	21.995767	-159.803406	0	516	516
6	22.010950	-159.810375	0	616	616

Site A potential temporary after-image

Axis tracking: Fixed (no rotation)
Tilt: 20.0 deg
Orientation: 180.0 deg
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	21.994629	-159.757369	14	0	14
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5	21.999603	-159.763570	19	0	19
6	22.000180	-159.762561	17	0	17
7	21.999762	-159.762325	17	0	17
8	22.000339	-159.761188	15	0	15

Summary of component results

Component	Green glare (min)	Yellow glare (min)	Red glare (min)
OP: 1	0	0	0
OP: 2	0	0	0
OP: 3	33	768	0
OP: 4	1480	471	0
OP: 5	353	9	0
OP: 6	0	0	0

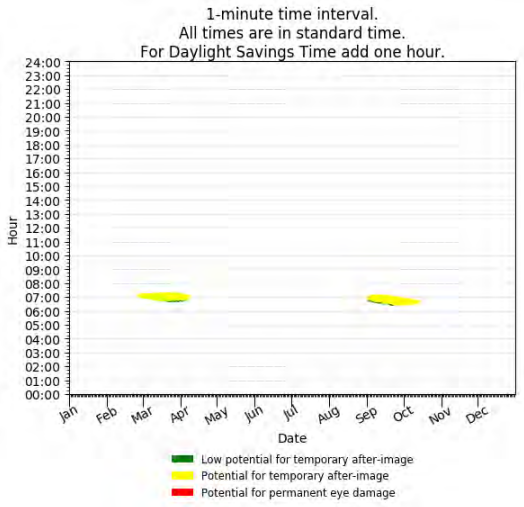
Observation point: 1

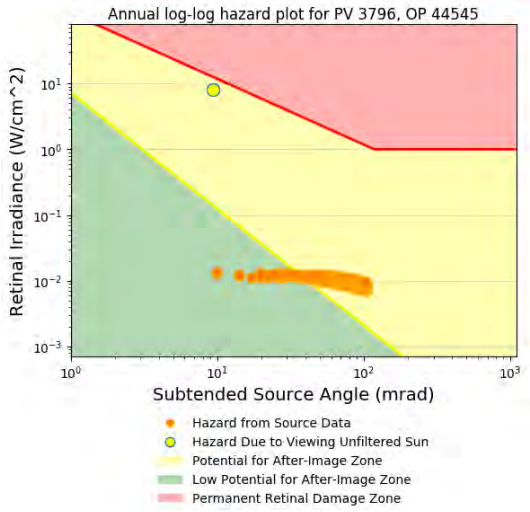
No glare found

Observation point: 2

No glare found

Observation point: 3





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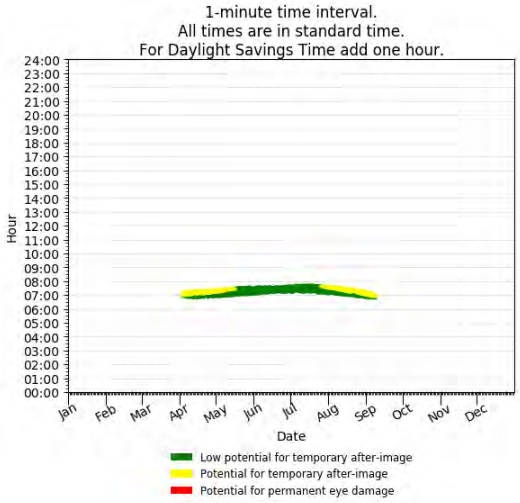
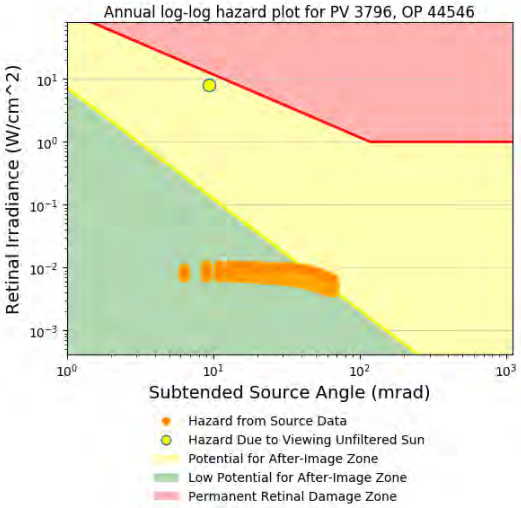
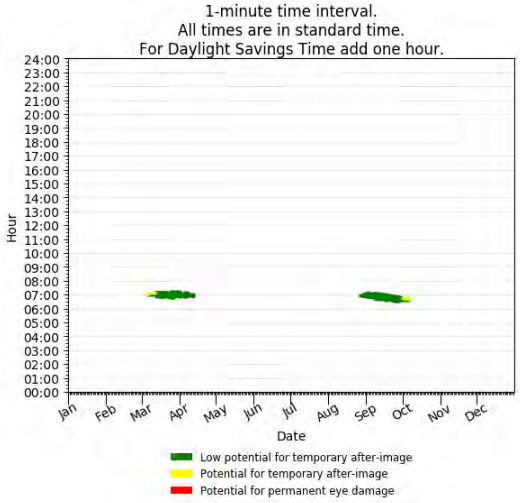
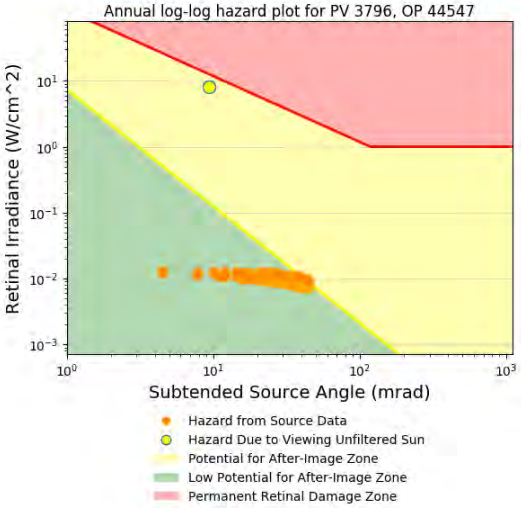




Observation point: 5





Observation point: 6

No glare found

ForgeSolar (/)
PV planning & glare analysis

Site config: Site A Runway 34 Fixed

No site config description provided.

Created **Sept. 8, 2016 12:53 a.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results No glare predicted!

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
Site A	20.0	180.0	0	0	0	-

Component Data

Flight Paths

Name: FP 1
Description:
Threshold height: 50 ft
Direction: 169.18 deg
Glide slope: 3.0 deg
Pilot view restricted? No

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	22.015102	-159.783601	10	50	60
2-mile point	21.986703	-159.777739	-97	710	613

Observation Points

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1	22.031231	-159.783453	14	60	74

Site A

Axis tracking: Fixed (no rotation)
Tilt: 20.0 deg
Orientation: 180.0 deg
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Tota elevat
	deg	deg	ft	ft	ft
1	21.994629	-159.757369	14	0	14
2	21.992441	-159.761424	16	0	16
3	21.994987	-159.762990	18	0	18
4	21.995485	-159.762111	17	0	17
5	21.999603	-159.763570	19	0	19
6	22.000180	-159.762561	17	0	17
7	21.999762	-159.762325	17	0	17
8	22.000339	-159.761188	15	0	15

No glare predicted!

ForgeSolar (/)
PV planning & glare analysis

Site config: site a runway 34 oval tracking

No site config description provided.

Created **Sept. 8, 2016 12:24 a.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results Glare with potential for temporary after-image predicted

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
Site A	0.0	180.0	5530	102	0	-

Component Data

Observation Points

Number	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total Elevation ft
1	22.031231	-159.783453	14	60	74
2	22.015097	-159.783595	10	66	76
3	21.998814	-159.780464	0	316	316
4	21.988214	-159.789742	0	466	466
5	21.995767	-159.803406	0	516	516
6	22.010950	-159.810375	0	616	616

Site A potential temporary after-image

Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Limit tracking rotation? No
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total elevation ft
1	21.994629	-159.757369	14	0	14
2	21.992441	-159.761424	16	0	16
3	21.994987	-159.762990	18	0	18
4	21.995485	-159.762111	17	0	17
5	21.999603	-159.763570	19	0	19
6	22.000180	-159.762561	17	0	17
7	21.999762	-159.762325	17	0	17
8	22.000339	-159.761188	15	0	15

Summary of component results

Component	Green glare (min)	Yellow glare (min)	Red glare (min)
OP: 1	0	0	0
OP: 2	0	0	0
OP: 3	2515	86	0
OP: 4	2047	0	0
OP: 5	446	16	0
OP: 6	522	0	0

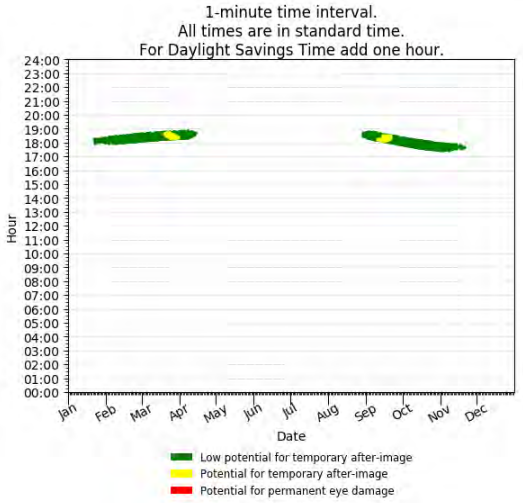
Observation point: 1

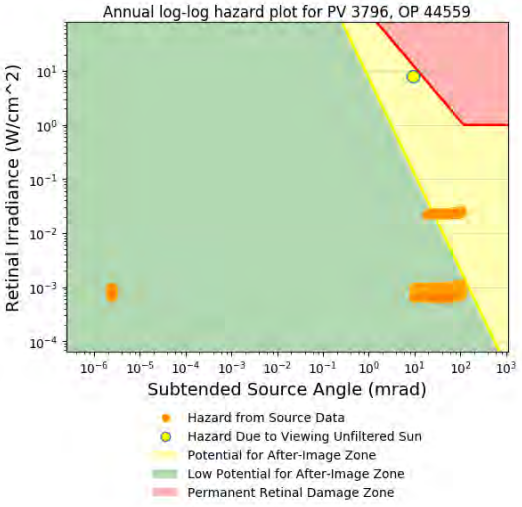
No glare found

Observation point: 2

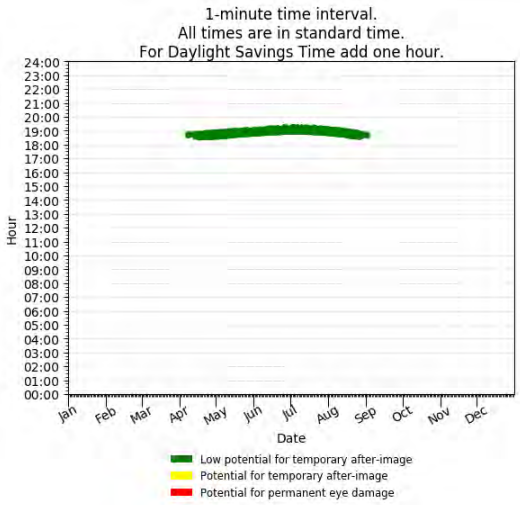
No glare found

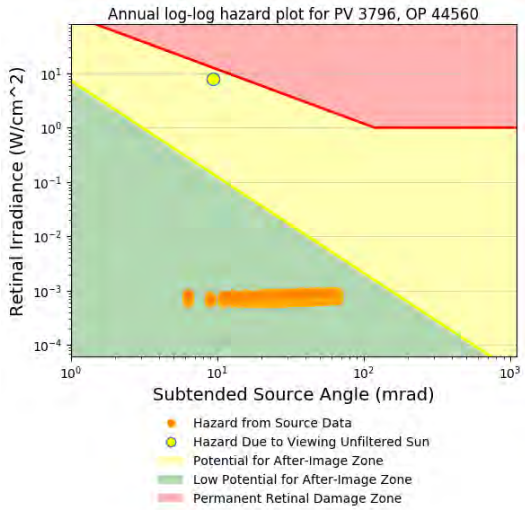
Observation point: 3



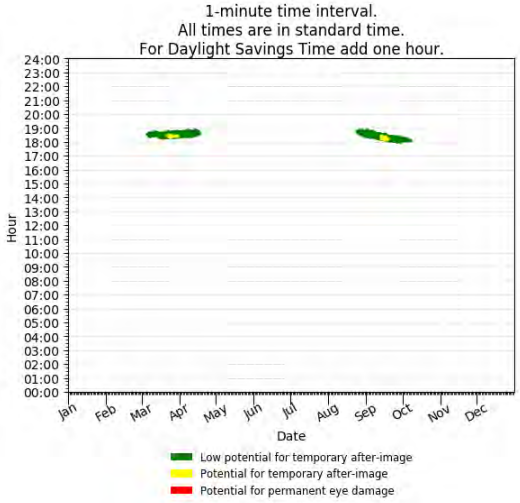


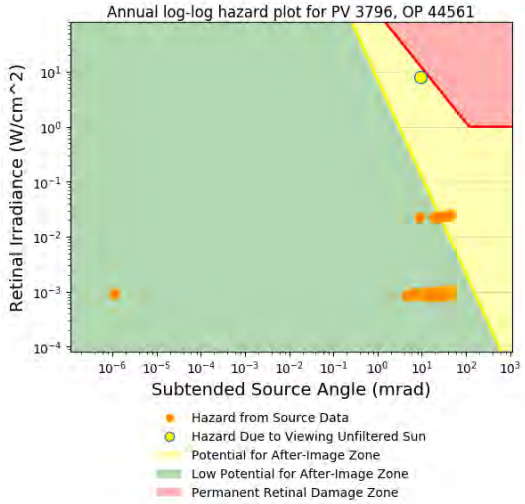
Observation point: 4



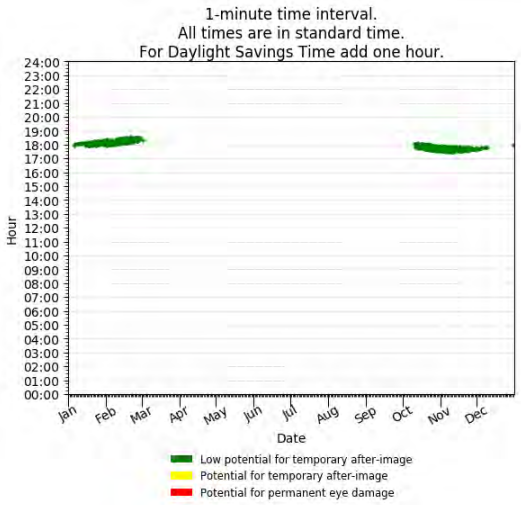


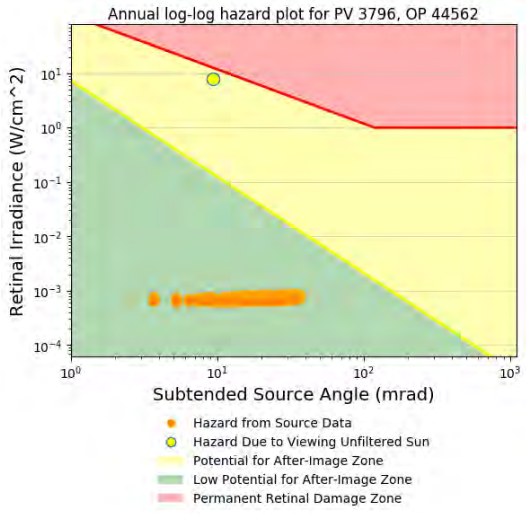
Observation point: 5





Observation point: 6





ForgeSolar (/)
PV planning & glare analysis

Site config: Site A Runway 34 Tracking

No site config description provided.

Created **Sept. 8, 2016 12:53 a.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results No glare predicted!

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
Site A	0.0	180.0	0	0	0	-

Component Data

Flight Paths

Name: FP 1
Description:
Threshold height: 50 ft
Direction: 169.18 deg
Glide slope: 3.0 deg
Pilot view restricted? No

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	22.015102	-159.783601	10	50	60
2-mile point	21.986703	-159.777739	-97	710	613

Observation Points

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1	22.031231	-159.783453	14	60	74

Site A

Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Limit tracking rotation? No
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Tota elevat
	deg	deg	ft	ft	ft
1	21.994629	-159.757369	14	0	14
2	21.992441	-159.761424	16	0	16
3	21.994987	-159.762990	18	0	18
4	21.995485	-159.762111	17	0	17
5	21.999603	-159.763570	19	0	19
6	22.000180	-159.762561	17	0	17
7	21.999762	-159.762325	17	0	17
8	22.000339	-159.761188	15	0	15

No glare predicted!

ForgeSolar (/)
PV planning & glare analysis

Site config: area B

No site config description provided.

Created **Sept. 6, 2016 10:34 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results No glare predicted!

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
PV B fixed	20.0	180.0	0	0	0	-

Component Data

Flight Paths

Name: FP 1
Description:
Threshold height: 50 ft
Direction: 350.53 deg
Glide slope: 3.0 deg
Pilot view restricted? No

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	22.030854	-159.786583	19	50	69
2-mile point	22.059372	-159.791721	-45	668	622

Observation Points

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1	22.031231	-159.783453	14	60	74

PV B fixed

Axis tracking: Fixed (no rotation)
Tilt: 20.0 deg
Orientation: 180.0 deg
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Tota elevat
	deg	deg	ft	ft	ft
1	21.989101	-159.759386	10	0	10
2	21.989778	-159.758055	10	0	10
3	21.991210	-159.758291	11	0	11
4	21.992404	-159.755716	10	0	10
5	21.985639	-159.751146	11	0	11
6	21.984983	-159.753807	12	0	12
7	21.986694	-159.756832	11	0	11
8	21.986296	-159.757755	11	0	11

No glare predicted!

ForgeSolar (/)
PV planning & glare analysis

Site config: area B

No site config description provided.

Created **Sept. 6, 2016 10:34 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results No glare predicted!

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
PV B tracking	20.0	180.0	0	0	0	-

Component Data

Flight Paths

Name: FP 1
Description:
Threshold height: 50 ft
Direction: 350.53 deg
Glide slope: 3.0 deg
Pilot view restricted? No

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	22.030854	-159.786583	19	50	69
2-mile point	22.059372	-159.791721	-45	668	622

Observation Points

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1	22.031231	-159.783453	14	60	74

PV B tracking

Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Limit tracking rotation? No
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Tota elevat
	deg	deg	ft	ft	ft
1	21.989101	-159.759386	10	0	10
2	21.989778	-159.758055	10	0	10
3	21.991210	-159.758291	11	0	11
4	21.992404	-159.755716	10	0	10
5	21.985639	-159.751146	11	0	11
6	21.984983	-159.753807	12	0	12
7	21.986694	-159.756832	11	0	11
8	21.986296	-159.757755	11	0	11

No glare predicted!

(/)

Site config: site b runway 34 oval fixed

No site config description provided.

Created **Sept. 7, 2016 11:40 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results Glare with potential for temporary after-image predicted

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
PV B fixed	20.0	180.0	326	542	0	-

Component Data

Observation Points

Number	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total Elevation ft
1	22.031231	-159.783453	14	60	74
2	22.015097	-159.783595	10	66	76
3	21.998814	-159.780464	0	316	316
4	21.988214	-159.789742	0	466	466
5	21.995767	-159.803406	0	516	516
6	22.010950	-159.810375	0	616	616

PV B fixed potential temporary after-image

Axis tracking: Fixed (no rotation)
Tilt: 20.0 deg
Orientation: 180.0 deg
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total elevation ft
1	21.989101	-159.759386	10	0	10
2	21.989778	-159.758055	10	0	10
3	21.991210	-159.758291	11	0	11
4	21.992404	-159.755716	10	0	10
5	21.985639	-159.751146	11	0	11
6	21.984983	-159.753807	12	0	12
7	21.986694	-159.756832	11	0	11
8	21.986296	-159.757755	11	0	11

Summary of component results

Component	Green glare (min)	Yellow glare (min)	Red glare (min)
OP: 1	0	0	0
OP: 2	0	0	0
OP: 3	0	0	0
OP: 4	300	533	0
OP: 5	26	9	0
OP: 6	0	0	0

Observation point: 1

No glare found

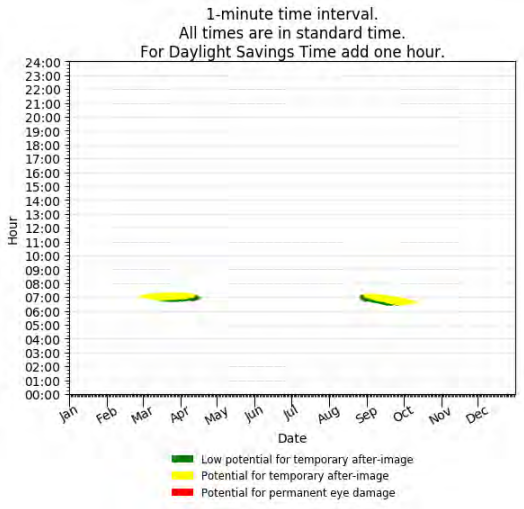
Observation point: 2

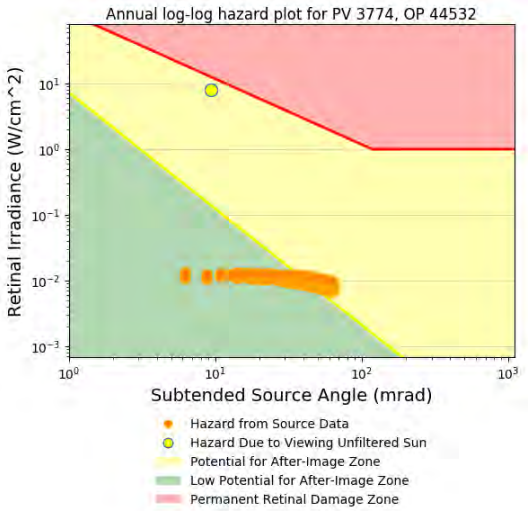
No glare found

Observation point: 3

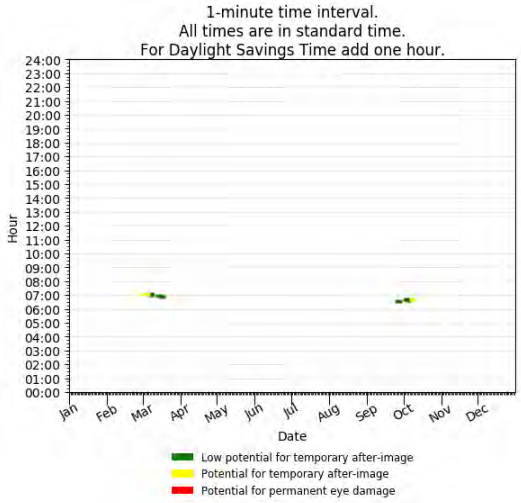
No glare found

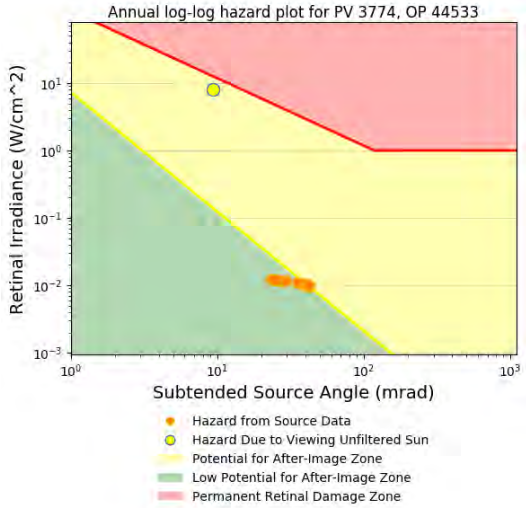
Observation point: 4





Observation point: 5





Observation point: 6

No glare found

ForgeSolar (/)
PV planning & glare analysis

Site config: Site B runway 34 fixed

No site config description provided.

Created **Sept. 7, 2016 10:23 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results No glare predicted!

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
PV B fixed	20.0	180.0	0	0	0	-

Component Data

Flight Paths

Name: FP 1
Description:
Threshold height: 50 ft
Direction: 169.0 deg
Glide slope: 3.0 deg
Pilot view restricted? No

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	22.015092	-159.783606	10	50	60
2-mile point	21.986710	-159.777648	-96	709	613

Observation Points

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1	22.031231	-159.783453	14	60	74

PV B fixed

Axis tracking: Fixed (no rotation)
Tilt: 20.0 deg
Orientation: 180.0 deg
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Tota elevat
	deg	deg	ft	ft	ft
1	21.989101	-159.759386	10	0	10
2	21.989778	-159.758055	10	0	10
3	21.991210	-159.758291	11	0	11
4	21.992404	-159.755716	10	0	10
5	21.985639	-159.751146	11	0	11
6	21.984983	-159.753807	12	0	12
7	21.986694	-159.756832	11	0	11
8	21.986296	-159.757755	11	0	11

No glare predicted!

ForgeSolar (/)
PV planning & glare analysis

Site config: Site B runway 34 oval tracking

No site config description provided.

Created **Sept. 7, 2016 10:23 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results Glare with potential for temporary after-image predicted

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
PV B tracking	0.0	180.0	4280	67	0	-

Component Data

Observation Points

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1	22.031231	-159.783453	14	60	74
2	22.015097	-159.783595	10	66	76
3	21.998814	-159.780464	0	316	316
4	21.988214	-159.789742	0	466	466
5	21.995767	-159.803406	0	516	516
6	22.010950	-159.810375	0	616	616

PV B tracking potential temporary after-image

Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Limit tracking rotation? No
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	21.989101	-159.759386	10	0	10
2	21.989778	-159.758055	10	0	10
3	21.991210	-159.758291	11	0	11
4	21.992404	-159.755716	10	0	10
5	21.985639	-159.751146	11	0	11
6	21.984983	-159.753807	12	0	12
7	21.986694	-159.756832	11	0	11
8	21.986296	-159.757755	11	0	11

Summary of component results

Component	Green glare (min)	Yellow glare (min)	Red glare (min)
OP: 1	0	0	0
OP: 2	0	0	0
OP: 3	2338	0	0
OP: 4	907	67	0
OP: 5	473	0	0
OP: 6	562	0	0

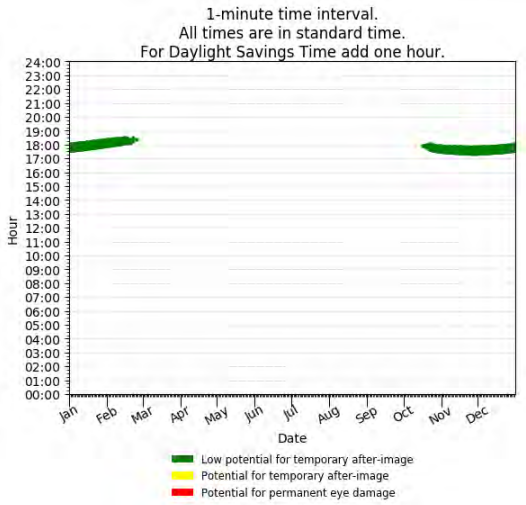
Observation point: 1

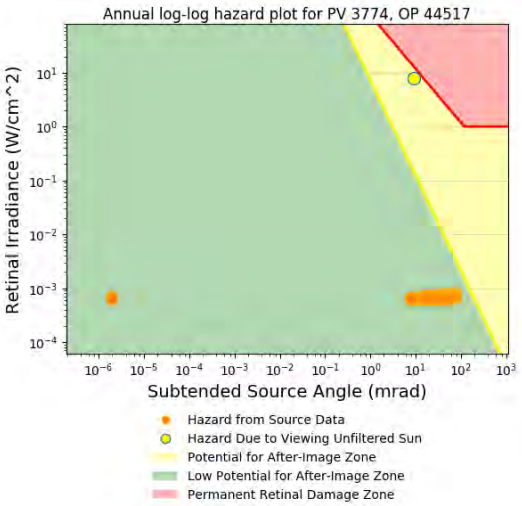
No glare found

Observation point: 2

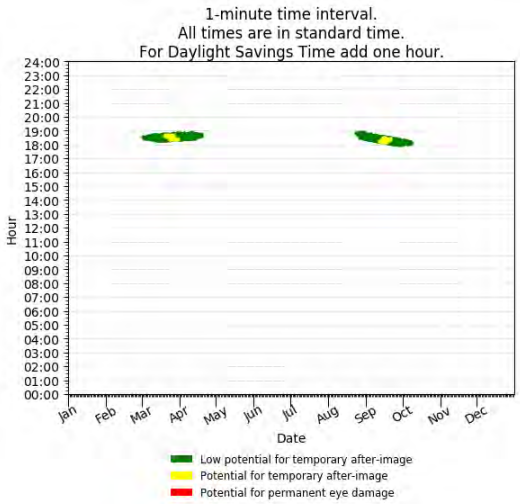
No glare found

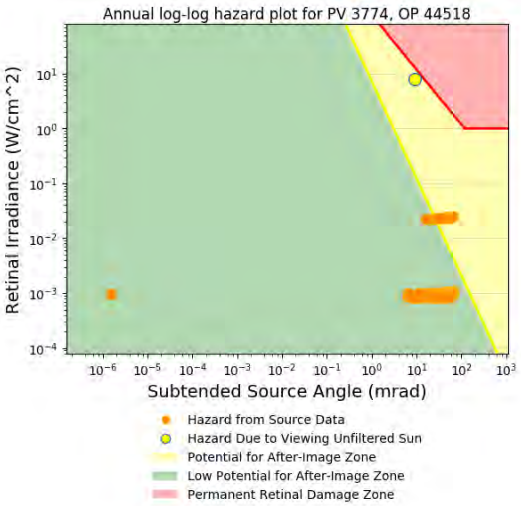
Observation point: 3



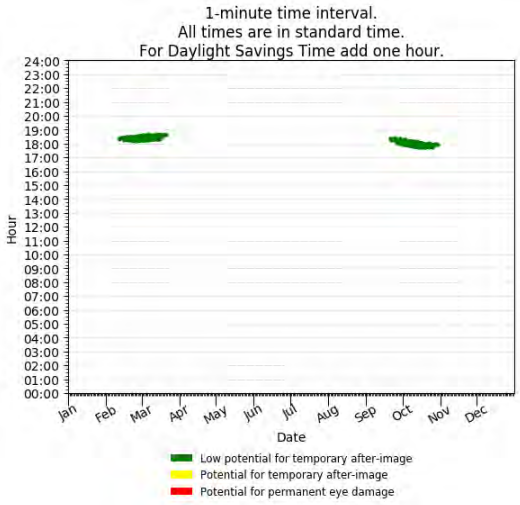


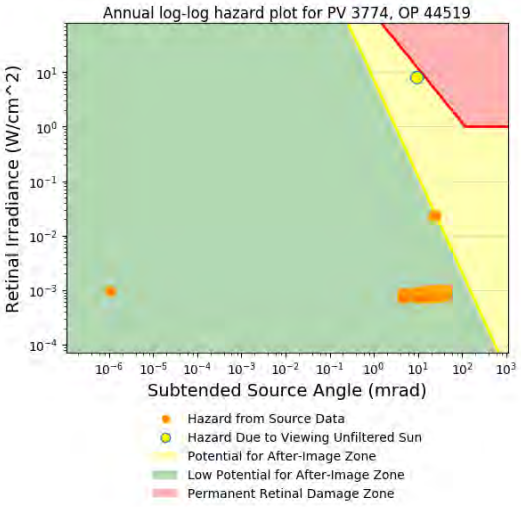
Observation point: 4



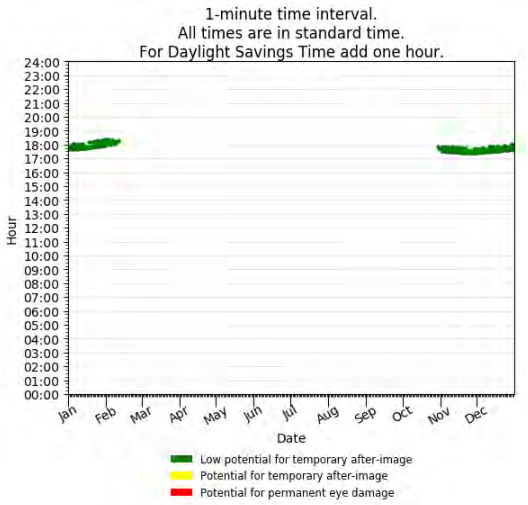


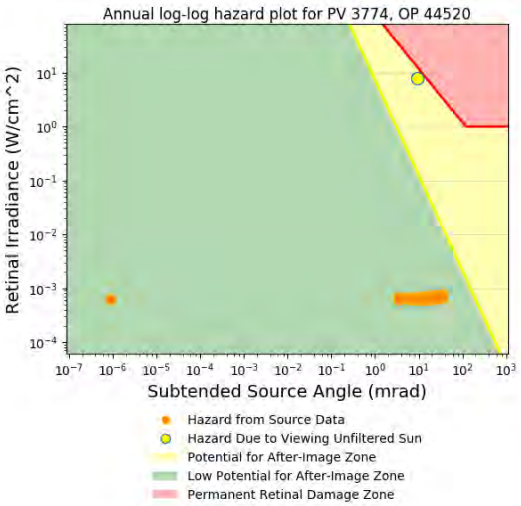
Observation point: 5





Observation point: 6





(/)

Site config: Site B runway 34 tracking

No site config description provided.

Created **Sept. 7, 2016 10:23 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.0066 ft pupil diameter
0.056 ft eye focal length
9.3 mrad sun subtended angle

Summary of Results No glare predicted!

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	"Red" Glare	Energy Produced
	deg	deg	min	min	min	kWh
PV B fixed	0.0	180.0	0	0	0	-

Component Data

Flight Paths

Name: FP 1
Description:
Threshold height: 50 ft
Direction: 169.0 deg
Glide slope: 3.0 deg
Pilot view restricted? No

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
Threshold	22.015092	-159.783606	10	50	60
2-mile point	21.986710	-159.777648	-96	709	613

Observation Points

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1	22.031231	-159.783453	14	60	74

PV B fixed

Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Limit tracking rotation? No
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? No
Slope error: 10.0 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Tota elevat
	deg	deg	ft	ft	ft
1	21.989101	-159.759386	10	0	10
2	21.989778	-159.758055	10	0	10
3	21.991210	-159.758291	11	0	11
4	21.992404	-159.755716	10	0	10
5	21.985639	-159.751146	11	0	11
6	21.984983	-159.753807	12	0	12
7	21.986694	-159.756832	11	0	11
8	21.986296	-159.757755	11	0	11

No glare predicted!